Effect of Comfrey (symhytum peregrinum) fed to pigs on meat quality traits

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Summary

Comfrey is known for the high crude protein content and substances which positively affect growth performance and health status of the pig. However little is known about the influence on determinant parameters of meat quality. In the present study 22 Large White pigs were fed based on liveweight, either a common growing-finishing diet (A) or the same diet supplemented with 10% leaves from comfrey (B). The animals were slaughtered at an average liveweight of 105 kilograms. Tissue samples of backfat and m. *longissimus dorsi* were collected 24 hours after slaughter. Animals of treatment B had lower stearic and palmitic ($P<.05$), but higher oleic and linolenic acid ($P<.05$) concentration in the adipose tissue than those of treatment A. The differences between treatments were not evident in the muscle lipids. Drip and cooking losses as well as both average pH values measured 45 minutes and 24 hours *post mortem* were not affected by the comfrey supplementation. With respect to colour measurements, the a* component (redness) and chroma tended to be higher ($P<.06$) in treatment B compared to A. Furthermore, the taste panel evaluation did not reveal any treatment differences. The data of the present study suggest, that a moderate comfrey supplementation has an impact on the composition of backfat lipids without affecting other meat quality traits.

Keywords: Comfrey, Symhytum peregrinum, Meat quality, Pigs

Introduction

Comfrey could be a cheap feedstuff for pigs, producing a high yield of forage with little labour especially as Keindorf & Keindorf (1978) reported that pigs seems to like it. As reported in earlier studies, the high protein content as well as other ingredients seem to favourably affect health and growth performance of growing finishing pigs. Nakanishi *et al.* (1978) reported no negative effect of dietary comfrey supplementation up to 25% of a growing-finishing diet on growth and slaughter performance compared to a control diet. However, the roots and leaves contain substantial quantities of Pyrrolizidin alkaloids (.01-.15% DM), which are known to be hepatotoxic (Abbott, 1988). Furthermore Keindorf & Keindorf (1978) reported that comfrey harvested from May to September contains considerably high amounts of nitrate (5.4 to 32 g/kg DM), which fed in higher dosages can unfavourably affect animal health.

To date little is known on the influence of dietary comfrey supplementation on meat quality traits. Therefore the present study was carried out to evaluate the impact of a 10% comfrey supplementation on the backfat fat composition as well as on meat quality parameters.

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Material and methods

Treatments

The experiment was conducted on Swiss Large White pigs (14 female and 9 castrated male pigs). At 25 kilograms liveweight, animals were randomly assigned to either a control base diet (A) or the base diet supplemented with 10% of comfrey meal (B). The feed was supplied according to a liveweight (LW) based regimen.

Sampling of meat and fat tissue

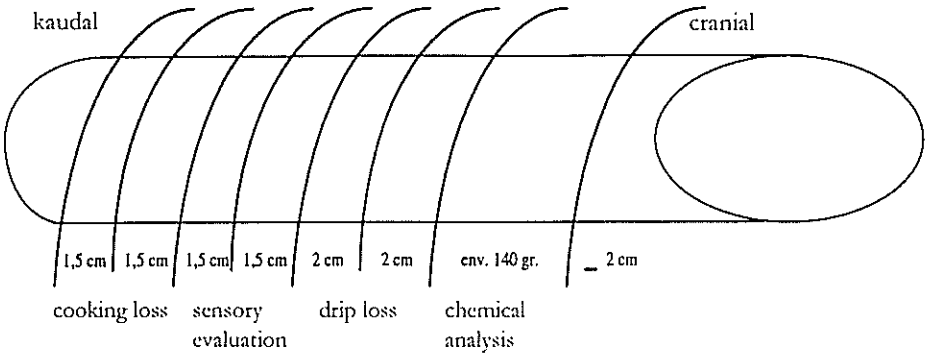

Figure 1. Sampling scheme for meat quality measurements in the longissimus dorsi muscle

The animals were slaughtered at an average LW of 105 kilograms in the slaughterhouse of the RAP. Following 24 hours of chilling the carcasses were dissected according to the guidelines of the MLP Sempach (Rebsamen *et al.*, 1995). At the height of the 9th rib pH measurements (WTW, Model pH196-S, Wintion Elektrode) in the *longissimus dorsi* muscle (LD) were assessed within 45 minutes (pH_i) and 24 hours (pH_u) *post mortem*. At the same position backfat tissue was collected for fatty acid profile analysis. LD muscle was taken from the position of the 9th rib and 20 cm backward for chemical analysis, drip loss, cooking loss and shear force measurements as well as sensory evaluation according to the scheme shown in Figure 1.

Meat quality measurements

Drip loss was measured according to standardised methods (Honikel, 1998) in 1.5 cm thick slices during 24 and 96 hours at 4°C. Samples to evaluate cooking losses were conditioned for four days at 4°C, subsequently vacuum-packed and stored at –20°C. 24 hour prior cooking samples were thawed at 4°C and subsequently cooked on a grill plate (190-195°C; Beer Grill AG, Zürich, Schweiz). Samples were weighed after each step and losses during conditioning, freezing and cooking were estimated. After cooking, samples were cooled and sheared (five individual measurements per sample) on a Warner Bratzler apparatus (Salter, Manhattan, USA). All measurements were carried out in duplicate. Colour of LD was measured using a Minolta Chroma Meter CR-300 with the light source D_{65} (Minolta, Dietikon, Switzerland) to obtain L*, a*, and b* and to calculate the Chroma values.

Sensory evaluation

The eating quality was assessed by a trained sensory panel (12 panelists). The samples were prepared as loin chops and cooked as stated before. The chops were evaluated for taste intensity by a pair wise comparison. It was emphasised that the comparisons were carried out with samples from animals of the same litter, sex and slaughter date. To avoid the effect of the order (samples from treatment A vs. treatment B) during the sensory evaluation the order was inverse for half of the panelists.

Chemical analysis

Chemical analysis of the muscle (dry matter, crude ash, protein, crude fat and fatty acid profile of muscle lipid) and of the backfat tissue (dry matter and fatty acid profile) was carried out according to methods of the accredited laboratory of the Swiss Federal Station for Animal Production – (RAP, Posieux, Switzerland).

Statistical analysis

The data were analysed by one-way-ANOVA with block design (NCSS 97, 1997). The pH, drip and cooking loss data were analysed as repeated measurements. In the tables results are presented as least square means and compared by least significant difference at $P < .05$. The sensory evaluation results correspond to discrete variables and follow a binomial distribution. To assess differences between treatments a double sided test was performed.

Results and discussion

Muscle and backfat tissue composition

Dry matter content of LD from animals of treatment A was lower than treatment B, but no further effects on nutrient composition could be detected (Table 1). The muscle lipid content amounted to 2.2 to 2.4 % in the wet tissue (9.0 to 9.8 % DM) and complies with the breeding strategy of the MLP Sempach for increased intramuscular fat content to achieve good meat quality in swine. In contrast to nutrient composition, the fatty acid profile from muscle (Table 1) and backfat lipids (Table 2) were affected by the dietary treatment. In the backfat and to a lesser extent in the LD, the amount of deposited saturated fatty acids (SFA) was lower due to comfrey supplementation, whereas monounsaturated fatty acid content (MUFA) was increased in the backfat but not in the LD. The differences were mainly on account of altered deposition of palmitic (16:0), stearic (18:0) and oleic acids (18:1). It is unlikely that the changes are connected with the dietary comfrey supplementation since the fat content of the plant is low and none of the cited fatty acids are present in high quantities. One possible explanation might be the lowered body fat deposition rate due to a slightly decreased growth of animals in treatment B (data not shown). These could account for the altered SFA amount due to lowered *de novo* synthesis (Chilliard, 1993) and/or higher Δ-9 desaturase activity.

Table 1. Dry matter, nutrient composition (g/kg) and fatty acid profile of LD.

	Treatment		
	A	B	*P*
Dry matter (%)	24.7	24.0	.035
Crude ash	43.3	43.9	.589
Crude protein	850.6	864.9	.114
Crude fat	98.2	90.4	.434
Fatty acid profile (g/kg total lipid)			
16:0	26.38	25.67	.042
18:0	13.90	13.30	.108
18:1	43.53	43.69	.787
18:2	6.96	7.78	.218
18:3	.32	.43	<.001
20:4	1.67	1.81	.541
SFA	41.97	40.57	.048
MUFA	48.13	48.20	.922
PUFA	9.89	11.17	.192

Table 2. Fatty acid profile of backfat lipids.

	Treatment		
	A	B	*P*
Fatty acid profile (g/kg total lipid)			
16:0	25.73	25.06	.011
18:0	16.72	15.22	.001
18:1	39.47	41.59	.002
18:2	10.64	10.32	.328
18:3	.84	.96	<.001
20:4	.08	.06	.043
SFA	44.35	42.19	<.001
MUFA	42.88	45.26	.002
PUFA	12.78	12.55	.535

Meat quality traits

The meat quality traits are shown in Table 3. The pH value measured in the LD muscle 45 minutes (pH_i) and 24 hours (pH_u) *post mortem* indicate a normal pH decline during the 24 hours post slaughter. At both time points no significant treatment effects could be detected. Four and three animals respectively had 45 minutes *post mortem* pH values in the range of 5.60 and 5.79, and below 5.60, respectively which indicate an incidence of PSE. However, the occurrence was not related to one of the treatments which is in agreement with previous results (Dufey, 1998) and point out that within the same breed among lines the glycolytic potential of the LD muscle varies. The L* (lightness) and b* values were not affected by the dietary treatments. However, the a* (redness, P = .05) and Chroma values (colour saturation, P = .07) tended to be higher in the comfrey treated group. Drip loss and losses after freezing and cooking as well as shear force values were not affected by the diet. Although apparently the same method was used to assess drip loss, the present values are higher compared to other

studies (Karlsson *et al.*, 1993; Maribo *et al.*, 1998), but are in agreement with results of previous investigations at our laboratory (Dufey, 1998).
The aim of the sensory analysis was to detect possible effects of comfrey on taste intensity. The results revealed no differences on eight out of the eleven pair wise comparisons. Where a difference (three pair wise comparisons) was noticed, the chops from animals in treatment A had a stronger taste. The panelists could no further describe the stronger taste. We stopped doing additional sensory analysis, since the results from the screening turned out very clear.

Table 3. Meat quality traits.

	Treatment		
	A	B	*P*
pH_i	5.82	5.86	
pH_u	5.38	5.43	.122
CIE colour			
L*	51.9	51.2	.470
a*	6.0	7.0	.050
b*	2.2	2.5	.439
Chroma value	6.4	7.4	.067
Drip loss (%)			
0 – 24 hr	7.05	8.55	
24 – 96 hr	4.84	3.48	.831
0 – 96 hr	11.97	11.94	.966
Water holding capacity (%)			
after freezing	16.97	17.78	
after cooking	18.36	18.92	.195
Total loss	32.23	33.31	.205
Shear force (kg)	3.80	3.66	.363

The present results on nutrient composition and meat quality traits demonstrate, that comfrey supplied to growing-finishing pigs at a level of 10% of the diet had only minor impacts on meat quality parameters.

References

Abbott, P. J., 1988. Comfrey: assessing the low-dose health risk. Medical Journal of Australia 149: 678-682

Chilliard, Y., 1993. Dietary fat and adipose tissue metabolism in ruminants, pigs, and rodents: a review. J. Dairy Sci. 76: 3897-3931

Dufey, P.-A., 1998. Engraissement des porcs avec un apport supplémentaire de vitamine E dans la ration. II. Effets sur les propriétés sensorielles et physicho-chimiques de la viande. Revue Suisse Agricol. 30: 186-193

Honikel, K. O., 1998. Reference methods for the assessment of physical characteristics of meat. Meat Sci. 49: 447-457

Karlsson, A., A.C. Enfalt, B. Essen-Gustavsson, K. Lundstrom, L. Rydhmer & S. Stern, 1993. Muscle histochemical and biochemical properties in relation to meat quality during selection for increased lean tissue growth rate in pigs. J.Anim.Sci. 71: 930-938

Keindorf, A. & H. J. Keindorf, 1978. Nitrate and nitrite poisoning in pigs caused by eating comfrey. Monatshefte für Veterinärmedizin 33: 425-427

Maribo, H., E.V. Olsen, P. Barton-Gade, A.J. Møller & A. Karlsson, 1998. Effect of early post-mortem cooling on temperature, pH fall and meat quality in pigs. Meat Sci. 50: 115-129

Nakanishi, G., M. Akahori, T. Ohmi & Y. Niwa, 1978. Studies on the suitability of comfrey as feed for pigs. Food Science and Technology Abstracts 35: 271-281

NCSS 97, 1997. NCSS 97, Ed. 97, Number Cruncher Statistical Systems, Kaysville, Utah, USA.

Rebsamen, A., D. Schwörer & D. Lorenz, 1995. Die Schlachtkörperzerlegung beim Schwein in der MLP Sempach. Der Kleinviehzüchter 43: 223-259