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GreenPork - impact of grass-protein to slaughter pigs on final meat quality (#414)

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Introduction

The market for organic pork is expanding in Denmark, however the production is challenged by facts like increased ammonia emission from organic pig production systems, partly caused by a suboptimal amino acid composition of the protein feed. So far, the organic protein sources are based on imported soy, contrasting also with the organic principles. In addition, the crop rotation in organic pig farms has problems with perennial weeds causing low yields, thus introduction of crops, which can minimize this load, is beneficial. Feeding organic pigs with bio-refined protein from grassland crops would lead to an organic pork production that is based on local feed, 100% organic and which is beneficial for carbon sequestration, biodiversity, weed management, and resource efficiency.

The composition of the feed affects the meat and eating quality of organic pork, which is related to the incorporation of fatty acids from the feed into subcutaneous and intramuscular fat, giving rise to changes in functionality and flavour. Grass-protein products have a high content of poly-unsaturated fatty acids, specifically ω-3 fatty acids and a high iodine value, thus inclusion of this feed component in the diet may have an impact on the risk of oxidation, the flavor and the firmness of the fat. The protein source itself might also affect the flavor of pork, although the impact of grass-protein is not studied.

The aim of this experiment was to study the effect of grass-protein as protein source for slaughter pigs on the meat and eating quality. We present the results of increasing amounts of a grass-protein product (0, 5, 10, and 15%) in the diet to slaughter pigs from weaning to slaughter on slaughter quality traits, colour of meat and fat and eating quality.

Methods

The grass-based protein was refined from organic clover-grass produced in the growth season 2018. The content of crude protein (CP) was 47% in the grass-protein product.

Forty-eight D-LY sow pigs were included in the experiment from one week post-weaning (48 d old), and raised at the pig facilities at Aarhus University. The pigs were raised in groups of 3 pigs (16 groups) and were offered one of the four diets with 0, 5, 10 or 15 % grass-protein product. From d 48 the pigs were offered a starter diet (CP 20.6%), from d 90 - 124 a grower diet (CP 18.6%), and finally from d 125 until slaughter at d 166 a finisher diet (CP 17%). The diets were primarily based on barley and wheat mixed with Chinese soy press cake, oat, peas and faba beans, and the specific amount of grass-protein product, which substituted primarily soy press cake and faba beans. The pigs were slaughtered at Danish Crown (Herning, Denmark), and 24 h post mortem the *M. longissimus lumborum* (LL) was sampled for meat quality analysis. pH and colour of meat and fat were measured. The Loin (LL) was aged for 7 d in vacuum at 4°C, frozen and used for sensory profiling by a trained panel (9 judges). The loins were thawed at 4°C for 20 h and sliced into six chops with a thickness of 20 mm. A frying plate was preheated to a temperature of 170°C, rubbed with sunflower oil and the chops were cooked to a core temperature of 68-70°C while turned after two, four and six minutes etc. The odour, taste, flavour and texture of the chops were evaluated on an unstructured scale from 0-15.

Data was analyzed using the proc mixed procedure in SAS, with diet as the main effect, and group and judge as random effects.

Results

The amount of grass-protein in the diets varied from 0 to 41% of the total crude protein in the diets (figure 1), however this did not have an effect on the final carcass weight, whereas the meat percentage increased with increased grass-protein in the diets (table 1). The meat became darker, less red and less yellow with increasing grass-protein levels in the diet, whereas the effect on fat colour was less clear, the 5 and 15 % diets gave darker, but more yellow fat in comparison to 0 and 10 % grass-protein (table 1).

The sensory profiling of the loin chops found no difference in the odour (not shown), whereas there was a tendency for decreased acid taste (P=0.08) and increased piggy flavour (P=0.08) with increased grass-protein in the diet, with no other differences between the 4 diets in taste and flavour (table 2). Juiciness, tenderness and bite resistance was unaffected by the diets, but an increased amount of fibrous tissue was recognized with increased grass-protein in the diet.

Conclusion

Pork raised on local produced bio-refined protein from clover-grass as part of their diet would be beneficial for the environment and the climate as well as the pork production fitting better with the organic principles. The results from this study have shown the potential in this strategy as there where only minor differences in the eating quality of the loin depending on the amount of grass-protein in the diet. To further confirm the potential in grass-protein for slaughter pigs the impact on oxidation and fatty acid composition will be studied.

Notes

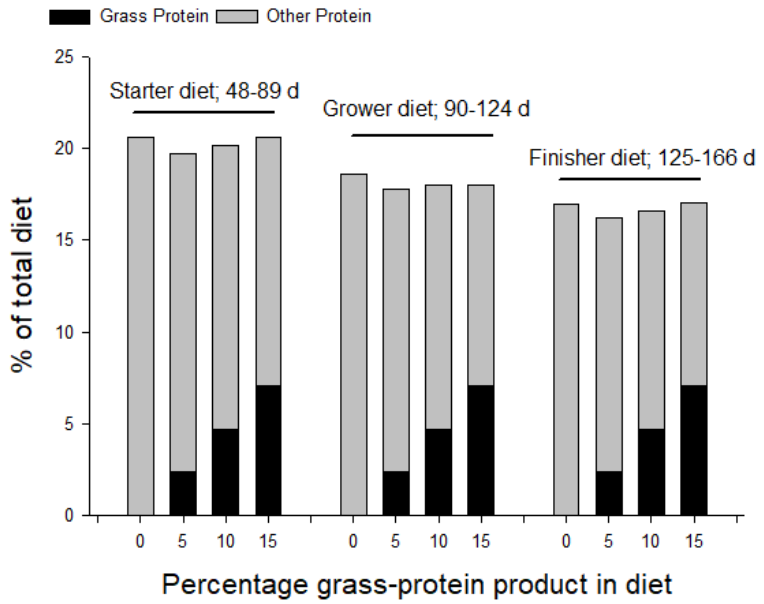

Figure 1
Percentage of grass protein in diets with 0, 5, 10 or 15% grass-protein product

Diet, % grass-protein product	0	5	10	15	SEM	P-value
Taste						
Acid	5.47	5.37	5.22	4.93	0.51	0.080
Sweet	3.99	4.10	3.95	4.06	0.48	0.877
Bitter	4.13	4.24	4.12	4.18	0.77	0.916
Flavour						
Roasted meat	7.66	7.47	7.44	7.20	0.30	0.142
Metallic	3.99	4.48	4.17	4.36	0.55	0.455
Piggy	3.47	3.69	3.57	4.03	0.69	0.082
Texture						
Juiciness	7.10	7.14	6.40	6.39	0.58	0.228
Tenderness	7.06	6.98	6.54	6.33	0.41	0.219
Fibrous	5.93^{b}	5.93^{b}	6.62^{a}	6.74^{a}	0.49	0.036
Chewing time	7.51	7.87	8.11	8.40	0.47	0.122

^{ab}LSMeans not sharing a common letter are significantly different (P<0.05)

Table 2
Sensory evaluation of pork loins from pigs fed 0, 5, 10 or 15% grass-protein product

Notes

Diet, % grass-protein product	0	5	10	15	SEM	P-value
Carcass weight, kg	90.3	91.7	93.2	93.8	4.33	0.935
Meat percentage, %	57.2^{b}	59.0^{ab}	58.7^{ab}	60.3^{a}	0.71	0.025
pH	5.69	5.66	5.69	5.70	0.026	0.634
Colour, *M. longissimus lumborum*						
L*	54.6^{a}	53.8^{ab}	54.3^{a}	52.7^{b}	0.46	0.026
a*	8.72^{a}	8.50^{a}	7.46^{b}	7.28^{b}	0.35	0.001
b*	7.40^{a}	7.17^{a}	7.01^{ab}	6.50^{b}	0.21	0.024
Colour, fat						
L*	78.2^{a}	76.6^{b}	77.5^{ab}	76.9^{b}	0.37	0.017
a*	4.97	5.92	5.16	4.96	0.31	0.104
b*	6.42^{c}	7.49^{ab}	6.61^{bc}	7.72^{a}	0.36	0.030

^{abc}LSMeans not sharing a common letter are significantly different (P<0.05)

Table 1
Slaughter and color characteristics of pigs fed 0, 5, 10 or 15% grass-protein product

Notes