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The effect of nettle *(Urtica dioica)* extract on fattening performance and fatty acid profile in the meat and serum lipids of pigs

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ABSTRACT

From a body weight of 60 to 112 kg, forty-two pigs were fed a standard diet that was either not supplemented (control) or supplemented with a dried water extract of nettle (NE) at a rate of 500 (group LN) or 1000 mg/kg (group HN). Protein deposition was greater in LN than in HN or control pigs. The higher level of NE resulted in decreased body weight gains and increased loin eye area. NE induced changes in the fatty acid profile of meat, but in the blood, it failed to affect the total cholesterol (TC) concentration , while decreasing the HDL level and TC/HDL ratio.

KEY WORDS: nettle, pig performance, fatty acids, lipid fractions

INTRODUCTION

Lately, herbal extracts and preparations, as sources of bioactive substances affecting pork quality, are being proposed as dietary additives for pigs (Cullen et al., 2005, Velasquez et al., 2005). Nettle is reported to have medical (Viegi et al., 2003), antioxidative (Toldy et al., 2005) and growth-stimulating (Krusiński, 2004) properties. It is hypothesized that it may also affect protein and lipid metabolism and improve the quality of pig products.

The aim of the experiment was to assess whether nettle extract supplemented to the feed for finishing pigs influences protein deposition and carcass value, affects serum lipid parameters and fatty acid composition in meat, ultimately increasing the dietetic value of pork.

MATERIAL AND METHODS

The experiment was performed with 42 fattening pigs kept and fed individually. The animals originated from PL×LWP sows mated to Duroc×Pietrain boars. The

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pigs received a finisher diet (13.2 MJ ME, 151 g of crude protein and 7.9 g of lysine/kg) from 60 to 112 kg of body weight: group C (control, without additives) or supplemented with nettle extract in amounts of 500 or 1000 mg per kg of feed, groups LN and HN, respectively. The balance-digestibility experiment was carried out over 5 days preceded by a 10-day preliminary period using 18 barrows of the same origin, weighing about 60 kg. Water extract from nettle (NE) was a commercial preparation produced by Phytopharm Klęka S.A. (Poland).

The nitrogen content and basal nutrients in feed and faeces were analysed using standard methods (AOAC, 1990). Samples of *longissimus dorsi* muscle from the area of the last thoracic and first lumbar vertebra were taken for analysis of fatty acids. Fatty acid concentrations were estimated by gas chromatography. Blood samples for estimation of lipid levels were taken from the jugular vein. Lipid fractions were assayed in blood serum using enzymatic methods and Cormay's diagnostic sets. The significance of differences between the groups was calculated with one-way analysis of variance (ANOVA) and Duncan's multiple range test using the STATISTICA 5.1 software package.

RESULTS

Nettle extract did not affect dry matter or crude protein digestibility, while it decreased the digestibility of crude fibre (in groups LN and HN), ether extract (in group HN), and N-free extractives (in group LN). Nitrogen utilization (%) and protein deposition were significantly increased by the lower, but not by the higher nettle supplementation level (Table 1).

Table 1. Digestibility of nutrients, %

Item	No supplement	LN[1]	HN[2]	SEM
Dry matter	84	80	83	0.38
Crude protein	80	79	80	0.41
Ether extract	74^{B}	74^{B}	68^{A}	0.89
Crude fibre	48^{B}	33^{A}	36^{A}	2.11
N-free extractives	88^{B}	84^{A}	87^{B}	0.38
Nitrogen retention, %	45.1^{ab}	53.9^{b}	41.2^{a}	1.91
Protein deposition, g per day	172^{a}	221^{b}	178^{a}	7.86

^{a,b} - $P \leq 0.05$, ^{A,B} - $P \leq 0.01$

[1] nettle extract 500 mg/kg feed, [2] nettle extract 1000 mg/kg feed

Weight gain was not affected by the lower level of nettle extract, whereas it was decreased by the higher level. Nettle did not affect the meat content in primal cuts, whole carcass, or backfat thickness. Only loin eye area was increased due to supplementation of nettle extract at both levels (Table 2).

Table 2. Fattening performance and carcass quality indices

Item	Control	LN[1]	HN[2]	SEM
Average daily weight gains, g	891[b]	895[b]	847[a]	11.04
Feed conversion, kg kg^{-1}	3.40 [a]	3.40[a]	3.49[b]	0.04
Body weight at slaughter, kg	113.7	112.1	112.8	0.46
Cold dressing percentage	77.7[AB]	77.1[A]	78.2[B]	0.16
Meat content of primal cuts, kg	25.7	25.4	26.6	0.34
Loin eye area, cm^2	51.6[a]	55.6[ab]	57.3[b]	0.97
Carcass meat content, %	55.3	56.8	56.5	0.54
Backfat thickness of 5 meas., cm	2.64	2.55	2.75	0.05
Backfat thickness at point C, cm	1.34	1.29	1.34	0.05
Composition of fatty acids in meat, g/100 g of all acids				
SFA	37.13	36.59	35.64	0.37
MUFA	47.06[B]	45.60[A]	44.54[A]	0.40
PUFA	15.81[A]	17.81[AB]	19.81[B]	0.67
PUFA n-6	14.08[A]	15.96[AB]	17.93[B]	0.64
PUFA n-3	0.67[Aa]	0.81[ABb]	0.87[Bb]	0.03

[a,b] - P≤0.05, [A,B] - P≤0.01, [1,2] see Table 1

Supplementation with nettle extract affected the fatty acid profile in loin fat. It tended to decrease SFA, decreased MUFA, and increased the proportion of PUFA, PUFA n-6, and PUFA n-3 (Table 2).

Among serum lipid parameters, total cholesterol tended to be lower while the high density lipoprotein (HDL) fraction was significantly lower in pigs fed on NE-supplemented diets. The triacylglycerol fraction also tended to decrease along with the level of NE supplementation (Table 3).

Table 3. Lipid fractions in blood serum

Item	Control	LN[1]	HN[2]	SEM
Total cholesterol (TC), mg/dl	110.06	100.72	104.75	2.23
Cholesterol HDL, mg/dl	50.06[bB]	45.00[aAB]	41.88[aA]	1.03
Cholesterol LDL, mg/dl	49.07	45.45	53.28	2.06
TC/HDL	0.46[b]	0.46[b]	0.40[a]	0.01
Triacylglycerol, mg/dl	54.57	51.58	47.48	2.12
Total lipids, mg/dl	436	424	398	6.86

[a,b] - P≤0.05, [A,B] - P≤0.01; [1,2] see Table 1

DISCUSSION

The effects of nettle extract were dose-dependent: some were found only at the lower or at the higher level of supplementation (weight gains and feed conversion, nitrogen utilization and protein deposition), and some responded in a linear manner (most of the fat parameters).

The higher N utilization and protein deposition in pigs fed the smaller amount of nettle extract suggests an anabolic effect of nettle. There is, however, a discrepancy between the considerable positive effect of nettle extract on N utilization and protein deposition in group LN and the lack of a significant effect on meat content in the primal cuts and whole carcass. Only a tendency towards a slightly higher carcass meat content and significantly greater loin area correspond with indices of more intensive protein anabolism. A possible explanation for this apparent inconsistency of balance and slaughter values may be that the duration of feeding NE was insufficient.

Fat metabolism was also affected by feeding nettle extract. While the total amount of fat, evaluated as backfat thickness, was not reduced by NE, the fatty acid profile of muscle (loin) fat was modified, indicating a reduction of monounsaturated and increase of polyunsaturated fatty acids in NE-fed pigs. The effect of nettle on lipid metabolism was confirmed by the significant reduction of HDL cholesterol and the tendency to decrease triacylglycerol concentrations in the serum of pigs fed on NE-supplemented diets.

The lack of an effect of NE on protein and dry matter digestibility seems to indicate an absence of substances impairing digestion. The negative linear effect on fibre digestion possibly implicates inhibition of intestinal microflora by NE, which may correspond with its health-promoting properties as described by Viegi et al. (2003).

CONCLUSIONS

Nettle extract used as a dietary supplement for finishing pigs affects protein deposition and fat metabolism since it modifies the fatty acid profile and lipid parameters in blood.

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