Influence of dietary supplementation with extracted alfalfa meal on meat quality

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Abstract

The aim of the research was to investigate the influence of dietary alfalfa meal supplementation of pig diets (2 g per 1 kg diet) on potential redox, myoglobin forms and lipid oxidation of pork loin. Investigation was carried out on 40 hybrid fatteners [(Polish Large White x Polish Landrace) x Duroc] at a body weight at slaughter approximately 125 kg. Lipid oxidation was assessed by the 2-thiobarbituric acid method. Oxidation-reduction potential values were determined using pH-meter CPC-501 (Elmetron) and equipped with redox electrode (ERPt-13). The total myoglobin content and the proportion of the three myoglobin forms were determined based on the absorbance spectra of myoglobin extracted from meat samples. The examinations indicated that dietary extracted alfalfa meal supplementation of pig diets did not affect potential redox and lipid oxidation of pork loin.

Introduction

Withdrawing of antimicrobial of growth promoters (AGP) from the pig diets was an inducement for intensive investigation upon the utilization of the alternative feed additives, like organic acids, probiotics, herbs and oligosaccharides (Grela & Semeniuk, 2006). The investigation performed recently have shown that plant extracts, besides their antioxidative activity, can improve feed tastiness and have beneficial effect on intestinal microflora (Manzanila et al., 2004).

The aim of this experiment was to estimate the effect of feed supplementation with the alfalfa extract on quality of pig meat.

Material and methods

The experiment was carried out on 40 hybrid fatteners [(Polish Large White x Polish Landrace) x Duroc] of about 14 kg of their initial body weight. Two feedings groups, 20 gilts and 20 boars each, were formed in the experiment. Four animals were kept in each pen. Fatteners were fed according to NRC (1998) standards. The control diets did not contain any growth of promoters supplement. The mixture of experimental group contained 2 g extracted alfalfa meal per 1 kg diet. Sixteen animals were slaughtered at 125 kg of their body weight.

Measurement of pH

The pH of the samples was measured using pH-meter CPC-501 (Elmetron) equipped with a pH electrode ERH-111.

Oxidation-reduction potential (ORP)

ORP values were determined using pH-meter CPC-501 CPC-501 (Elmetron) set to the milivolt scale and equipped with redox electrode (ERPt-13).

Determination of myoglobin forms

The determination of the total of myoglobin content and of the proportion of oxymyoglobin, myoglobin and metmyoglobin in meat is based on the different absorbance spectra of these molecules in solution. Absorbance measurements were carried out at 525, 545, 565 and 572 nm on a Nicole Evolution 300 spectrophotometer (Thermo Elektron Corporation) after pigment extraction from meat samples (with a pH 6,8 sodium phosphate buffer). The proportion of myoglobin forms were calculated according to Krzywicki (1982).

Lipid oxidation was assessed by the 2-thiobarbituric acid method. The rose-pink colour obtained through the reaction between malondialdehyde and 2-thiobarbituric acid was measured at 532 nm using a Nicole Evolution 300 spectrophotometer (Thermo Elektron Corporation). The TBARS content was expressed as mg of malondialdehyde per kg of the samples.

Results and discussion

Recent results performed by Karwowska et al. 2007 did indicate the influence of dietary supplementation with extracted alfalfa meal on fattening time of pigs. The experimental group of animal gained almost the same body weight as the control group of pigs during lower time of feeding.

The examination of the acidity of loin indicated that dietary alfalfa extract supplementation of pig diets did not affect the pH values (Table 1). Meat of animals from control and experimental group had similar pH values during 6 days of storage.

Table 1. Values of acidity and myoglobin contents of meat (mean ± standard deviation)

Sample	Parameter	Storage time [day]		
		2	4	6
Control	Acidity	5,23±0,07	5,29±0,11	5,38±0,16
	Total myoglobin (mg/g)	3,8±0,67	3,5±0,77	3,6±1,04
	Mb (%)	36,8±2,85	37,3±2,69	35,9±1,73
	MbO_2 (%)	25,0±6,56	27,4±4,37	23,9±5,39
	MetMb (%)	21,6±3,73	22,1±2,74	23,9±5,25
Experimental	Acidity	5,18±0,02	5,28±0,03	5,35±0,12
	Total myoglobin (mg/g)	4,8±0,78	4,8±0,80	3,9±0,37
	Mb (%)	38,6±2,54	39,3±2,80	36,6±1,81
	MbO_2 (%)	22,0±4,82	17,7±1,36	23,8±3,56
	MetMb (%)	22,5±2,17	24,5±1,28	23,4±2,45

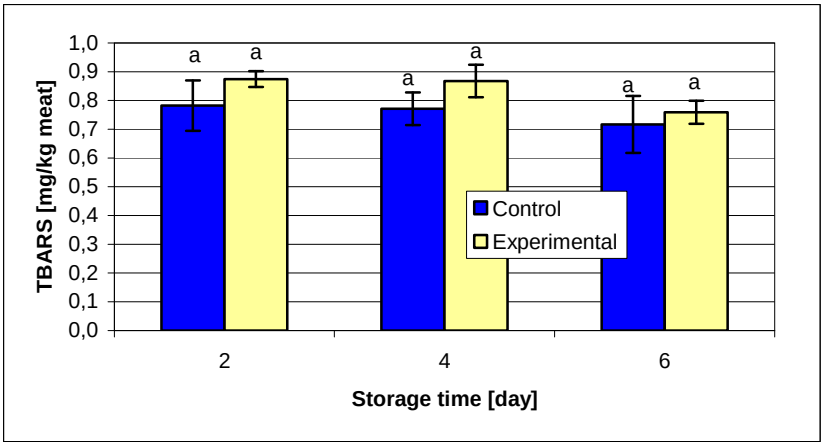

Figure 1. Lipid oxidation of meat (averages marked with the same letters are no significantly different (p>0,05)).

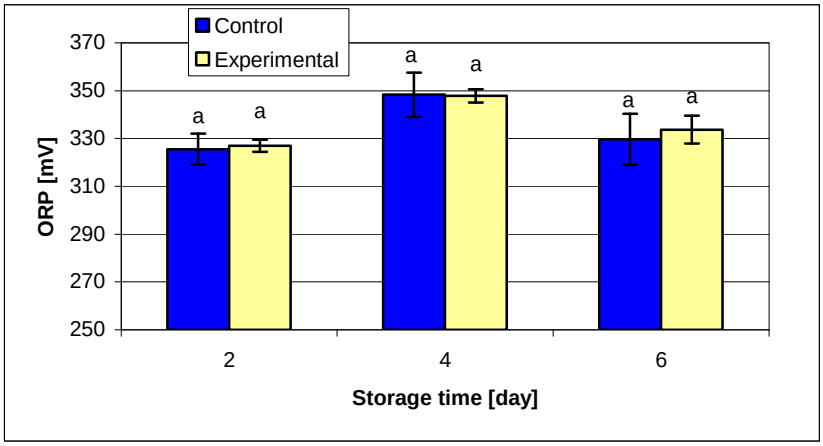

Figure 1. Potential redox values of meat (averages marked with the same letters are no significantly different (p>0,05)).

The total myoglobin content was higher for the meat samples from pigs receiving alfalfa extract and ranged from 3,9 mg/g to 4,8 mg/g (Table 1). The proportion of the three myoglobin forms were similar for control and experimental samples during the storage. Myoglobin was the main heme pigments form. The proportions of oxymyoglobin and metmyoglobin were lower and displayed high variability.

Potential redox (ORP) and lipid oxidation (TBARS values) were determined to elucidate oxidative changes in heme pigments of loin. Dietary alfalfa extract supplementation of pig diets did not affect potential redox and lipid oxidation of pork loin (Figure 1, Figure 2). The results of oxidation-reduction potential measurements of meat systems obtained by Cornforth et al. (1986) indicated that hemochrome formation was promoted by reducing conditions and prevented by oxidizing conditions. During the chilling storage of meat samples slight changes in TBARS values were noted. ORP values of meat samples of animals from control and experimental group increased after 4 days of storage. TBARS and ORP values of meat samples from pigs receiving alfalfa extract did not suggest its antioxidants activity. Antioxidants properties of lucerne extract were proved by Ben Aziz et al. (2006).

Conclusions

In conclusion, the addition of alfalfa extract to pig diets (2 g/kg feed) did not cause the deterioration of meat quality. Dietary supplementation with alfalfa extract accelerate the growth of pig.

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