

SELECTED INDICES OF MEAT AND CARCASS QUALITY OF PIGS FED GRASS OR MAIZE SILAGES SUPPLEMENTED WITH A HERB MIXTURE

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The effect of feeding pigs with maize or grass silage with or without herb mixture supplementation on chosen indices of carcass and meat quality was investigated on 128 pigs originated from sows (Polish Large White x Polish Landrace) mated with Duroc x Pietrain boar. Two groups of animals were fed restricted with mixture (12.9 MJ ME, 163 g of crude protein) composed of cereals, faba beans, rapeseed cake and vitamin-mineral supplements. Additionally, group I received *ad libitum* grass silage and group II – silage from chopped whole-plant maize. Half of animals in each group received 0.5% supplement of herb mixture.

Feeding pigs with grass silage improved all estimated carcass quality traits in comparison with group fed with whole-plant maize silage, however the statistically significant differences appeared only in case of meat content in carcass and backfat thickness. Meat obtained from pigs receiving grass silage was less yellow, characterized of lower water holding capacity and was more juicy. Fat contained slightly higher amount of UFA, especially MUFA ($p \leq 0.05$), and lower by 2.4% PUFA n-6/n-3 ratio.

Supplementation silage diet with herb mixture improved carcass quality, especially loin eye area (by 4.8%). Meat from pigs receiving silage with herb mixture was significantly more tasty (by 4%), tender (3.5%), juicy (by 8.2%) and had better smell.

In conclusion it can be stated that feeding pigs with grass silage improved evaluated carcass quality indices, meat colour and its water holding capacity when compared with pigs fed whole-plant maize silage. Herb mixture supplementation to the diet containing grass or maize silage positively influenced meat sensory traits.

INTRODUCTION

The consumers' requirements for quality of animal products increase since last years markedly. High quality of these products is connected not only with genetic factors but also with feeding system. Feeding pigs with diet containing fibrous feeds, especially in high amounts, may negatively influence the body weight gains. On the other side, the lower rate of body weight gain allow to obtain the carcasses of fine quality which meet the demands of a specific consumer segment. The another reason which leads farmers interest to home-grown feedstuffs is the economical pressure, such as periodically low profitability of pork production. In pig feeding the most important home-grown and fibrous feeds are various kind of silages. The beneficial effect of feeding pigs with concentrate and *ad libitum* roughage feed (silages) on carcass and meat quality traits were observed by Hansen *et al.* [2006] and Danielsen *et al.* [2000]. However, this kind of feeding may negatively affect the meat tenderness in comparison to meat from conventional fed pigs [Danielsen *et al.*, 2000].

There is a possibility of affecting the animals organisms by the selected herbs or herb mixtures. Herbal preparations can be used not only for young (weaned) pigs [Velasquez *et al.*, 2005] but also in grower-finisher pig feeding. Increasing of protein anabolism, weight gains, immunity and lowering the

harmfulness of antinutritive fodder's components is possible through onion, garlic, lemon balm and thyme supplementation. Pepper mint and coriander positively influence the processes digestive tract while nettle, pepper mint, couch-grass and garlic increase the feed intake. It was found that they can improve feed conversion ratio but their effects depend on species of a used plant [Cullen *et al.*, 2005]. Herb extracts have also health-related activity so they can be used as immunostimulants [Son *et al.*, 2004]. The property of single herb enable to stimulate chosen direction of animal production. In the experiment on pigs Krusiński [2004] found that dry herb of nettle improved animals body weight gains. The usage of herbs additive in feeding pigs receiving fibrous components as silages seems to be very beneficial.

The aim of this experiment was to investigate the effect of feeding pigs with maize or grass silage with or without herb mixture supplementation on chosen indices of carcass and meat quality.

MATERIAL AND METHODS

The experiment was carried out on 128 fattening pigs originated from sows (Polish Large White x Polish Landrace) mated with Duroc x Pietrain boar. Two groups of animals were fed restricted, according to individual body weight, with

mixture containing 12.9 MJ ME and 163g of crude protein and composed of barley, wheat, triticale, faba beans, rapeseed cake and vitamin-mineral supplements. Additionally, group I received *ad libitum* grass silage and group II – silage from chopped whole-plant maize. Half of animals in each group received 0.5% supplement of herb mixture. The herbs' mixture used in the present experiment contained lemon balm, peppermint, nettle, thyme, couch-grass, garlic, paprika, marjoram, coriander and milk-thistle. Animals were kept individually and fed with feed mixture twice a day. After both feedings appropriate silages were given and leftover feed was weighed before each feeding. Animals were kept in the experiment from about 30 to 114 kg of body weight. At the end of the experiment all animals were slaughtered. After 24-hours cooling in +4°C temperature the right sides of carcasses were evaluated according to SKURTCh [Różycki, 1995] methods. Meat content in carcass was evaluated using equation by Borzuta [1997]. Samples of *longissimus* muscle, obtained from the area of the last thoracic and first lumbar vertebra, were collected for meat analysis. In slices of fresh meat the colour was measured using colourimeter Minolta CR-310. Water holding capacity was estimated in fresh mince meat according to Grau & Hamm [1953] methods. The sensory traits of boiled meat were evaluated according to Barylko-Pikielna [1975] methods. The *longissimus* m. slices of similar size and weight, obtained from the area mentioned above, were boiled in 0.6% NaCl water solution. The smell, taste, tenderness and juiciness were scored using 1 (the worst) to 5 (the best) point scale. Backfat samples were taken from the same place as *longissimus* m. for fatty acid profile estimation (gas chromatograph Varian 3400). All data were subjected to analysis of variance and the differences between mean values were estimated using Duncan test (STATISTICA ver. 5.1).

RESULTS AND DISCUSSION

Feeding pigs with grass silage improved all presented carcass quality traits in comparison with group fed with whole-plant maize silage (Table 1), however the statistically significant differences appeared only in case of meat content in carcass (by 2.7 percent points) and backfat thickness (by 8.5%). Danielsen *et al.* [2000], when giving a mixture with

TABLE 1. Chosen indices of carcass quality.

Item	Silage type		Herb supplementation		SEM
	grass silage	maize silage	0%	0.5%	
Body weight at slaughter (kg)	114	113	114	113	0.24
Cold dressing yield (%)	78.58	78.71	78.68	78.60	0.14
Meat content in ham (%)	77.14	76.88	76.61	77.40	0.33
Meat of primal cuts (kg)	26.78	26.57	26.54	26.81	0.19
Loin eye area (cm ²)	58.06	57.08	56.23a	58.91b	0.54
Meat content in carcass (%)	60.98B	58.31A	59.57	59.73	0.41
Backfat thickness of 5 measurements (cm)	2.15A	2.35B	2.28	2.22	0.03

A, B – $p \leq 0.01$; a, b – $p \leq 0.05$

clover grass or clover grass silage also found higher by 1–2% meat content in carcass, which was due to the lower energy concentration in feed. In the present experiment meat obtained from pigs receiving grass silage was by 7% less yellow and characterized of lower water holding capacity (Table 2). The effect of feeding pigs with mixture and clover silage on carcass and meat quality was investigated also by Hansen *et al.* [2006]. In comparison to conventional feeding the experimental carcasses characterized of significantly higher meat content in carcass, heavier loin without rind and bones (by 4.8%) and heavier leg muscles (by 8.2%) as well as thinner fat thickness around loin and legs by 22 and 33%, respectively. The meat colour was not significantly affected by the diet.

The kind of silage used in the present experiment did not significantly affected the sensory traits of boiled meat, however the juiciness in group obtaining grass silage was by 3.9% higher, but tenderness was worsen. The diet containing clover silage also negatively influenced the tenderness of meat what was observed by Danielsen *et al.* [2000]. Such a result in pigs fed with roughage forage may be due to a slower body weight gain, in comparison to intensive fattening system, what decrease the proteolytic potential of muscle at the slaughter [Therkildsen *et al.*, 2002].

In the present experiment fat contained by 2% higher amount of UFA, especially MUFA ($p \leq 0.05$), and lower by 2.4% PUFA n-6/n-3 ratio (Table 3). The unsaturated composition of fatty acids was noticed also by other authors in meat from pigs fed with access to pasture grazing [Nilzen *et al.*, 2001] or fed with red clover silage [Johansson *et al.*, 2002]. Significantly higher content of PUFA in backfat of pigs fed with clover grass silage was noticed also by Hansen *et al.* [2006]. Such results, although the differences are numerically small, may indicate the lower technological value of meat products due to enhanced lipid oxidation and soft fat. According to previous experiment done by authors [Świątkiewicz & Hanczakowska, 2005] the supplementation of vitamin E to the diet containing silages may be taking into account. In that

TABLE 2. Chosen indices of meat quality.

Item	Silage type		Herb supplementation		SEM
	grass silage	maize silage	0%	0.5%	
Meat colour, Hunter scale:					
lightness (L)	44.96	44.68	44.44	45.20	0.27
redness (a)	12.41	12.35	12.45	12.31	0.07
yellowness (b)	2.13	2.29	2.25	2.17	0.06
Water holding capacity, %	21.12	21.46	21.11	21.47	0.25
pH 45 min after slaughter	6.29	6.26	6.27	6.28	0.02
pH after 24 h cooling	5.65	5.62	5.67	5.60	0.02
Sensory estimation:					
odour	4.70	4.71	4.67	4.73	0.02
taste	4.47	4.51	4.40A	4.58B	0.02
tenderness	4.33	4.39	4.28A	4.43B	0.03
juiciness	4.52	4.35	4.26A	4.61B	0.11

A, B – $p \leq 0.01$

TABLE 3. Composition of fatty acids in backfat (%).

Item	Silage type		Herb supplementation		SEM
	grass silage	maize silage	0%	0.5%	
SFA	40.03	41.23	40.58	40.68	0.34
UFA	59.97	58.77	59.42	59.32	0.34
MUFA	44.68b	43.38a	43.91	44.15	0.28
PUFA	15.28	15.39	15.51	15.17	0.22
PUFA n-6	12.66	12.78	12.86	12.57	0.21
PUFA n-3	0.77	0.76	0.77	0.75	0.01
PUFA n-6 / n-3 ratio	16.53	16.94	16.70	16.77	0.18

^{a, b} – $p \leq 0.05$

experiment the antioxidative role of higher doses of vitamin E in the diet containing maize silage was confirmed by significantly lower TBA-RS indicator.

Supplementation the silage diet with herb mixture improved carcass quality, especially loin eye area (by 4.8%), which was statistically significant ($p \leq 0.05$) and decreased by 2.6% backfat thickness (Table 1). Similar results were observed in the experiment done by Urbańczyk *et al.* [2002]. In their experiment addition of herb mixture increased loin eye area by 15% ($p \leq 0.05$) and carcass meatiness by 3.6 percent points and reduced backfat thickness by 8.4%. The tendency towards a slightly higher meat content in the carcass and significantly greater loin area (by 7–11%) depending on the amount of nettle supplementation were noticed by Szewczyk *et al.* [2006].

The influence of herb mixture supplementation to pig diet containing silages on meat quality indices shows Table 2. Colour of meat from pigs receiving silage and herb mixture was more light and by 3.5% less yellow in comparison to meat from pigs fed without the herb mixture. The herb mixture supplementation markedly affected the sensory traits of boiled meat. Significant differences ($p \leq 0.01$) were observed in case of meat taste, tenderness and juiciness, which were better in comparison to group fed silages without herb mixture by 4.1, 3.5 and 8.2%, respectively. The composition of fatty acids in backfat was not significantly influenced by herb mixture supplementation (Table 3). Szewczyk *et al.* [2006] observed the modification of meat fat, indicating the reduction of monounsaturated and increase of polyunsaturated fatty acids in pigs fed mixture containing nettle extract. The beneficial effect of adding the herb mixture to pig diet was noticed also by Urbańczyk *et al.* [2002]. In their experiment meat obtained from pigs fed with herb additive characterized of less by 1.3% saturation in yellow, lower water holding capacity and significantly higher juiciness and tenderness (by about 6%). The significant influence of sage, lemon balm or coneflower extracts on meat colour and lower water holding capacity was observed by Hanczakowska [2004]. The tendency towards improvement of smell, taste, tenderness and juiciness was noticed by Grela [2001] when fed pigs with mixture containing dried nettle plant, juniper fruits and roots of couch-grass.

CONCLUSIONS

In conclusion it can be stated that feeding pigs with grass silage improved some of the carcass quality traits, meat colour and its water holding capacity when compared to pigs fed whole-plant maize silage. Herb mixture supplementation to the diet containing grass or maize silage positively influenced meat sensory characteristics.

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WYBRANE WSKAŹNIKI JAKOŚCI TUSZY I MIĘSA ŚWIŃ ŻYWIONYCH KISZONKĄ Z TRAW LUB Z CAŁYCH ROŚLIN KUKURYDZY Z DODATKIEM MIESZANKI ZIOŁOWEJ

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Wpływ żywienia świń kiszonką z traw lub z całych roślin kukurydzy, z dodatkiem lub bez mieszanki ziołowej, na wybrane parametry jakość tuszy i mięsa badano na 128 tucznikach pochodzących od loch (wbp x pbz) pokrytych knurem (D x Pi). Dwie grupy zwierząt otrzymywały dawkowane ilości mieszanki (12,9 MJ EM, 163 g białka ogólnego) zawierającej zboża, bobik oraz makuchy rzepakowe. Ponadto grupa I otrzymywała do woli kiszonkę z traw, a grupa II z całych roślin kukurydzy. Połowa zwierząt w każdej grupie otrzymywała w mieszance 0,5% dodatek mieszanki ziołowej.

Zastosowanie kiszonki z traw w tuczu świń poprawiło badane cechy tuszy w porównaniu do grupy otrzymującej kiszonkę z kukurydzy, jednakże statystycznie istotne różnice wystąpiły jedynie w przypadku mięsności tuszy oraz grubości słoniny. Mięso tuczników żywionych kiszonką z traw było mniej żółte, posiadało niższy wskaźnik wodochłonności i było bardziej soczyste. Tłuszcz słoniny charakteryzował się nieco wyższą zawartością UFA, szczególnie MUFA ($p \leq 0,05$), oraz niższym o 2,4% stosunkiem PUFA n-6/n-3. Dodatek mieszanki ziołowej do dawki zawierającej kiszonki poprawił jakość tuszy, szczególnie powierzchnię oka polędwicy (o 4,8%). Mięso świń otrzymujących kiszonkę oraz mieszankę ziołową charakteryzowało się wyraźnie lepszym smakiem (o 4%), większą kruchością (o 3,5%) i soczystością (o 8,2%) oraz lepszym zapachem.

Podsumowując wyniki przeprowadzonego doświadczenia można stwierdzić, że zastosowanie w żywieniu świń kiszonki z traw poprawiło niektóre cechy jakościowe tuszy, barwę mięsa oraz wskaźnik wodochłonności, w porównaniu do parametrów obserwowanych u świń żywionych kiszonką z całych roślin kukurydzy. Dodatek mieszanki ziołowej do dawki zawierającej kiszonkę z traw lub kukurydzy pozytywnie wpłynął na cechy organoleptyczne mięsa.