

THE EFFECT OF ADDITION OF RAPESEED MEAL ON THE QUALITY OF PORK MEAT AND FAT

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Abstract

The aim of this study was to evaluate the effect of rapeseed meal addition on the selected physical characteristics of pig meat and fat quality. Seventy-two pigs (DanBred) \times (CLW \times CL) were divided into two experimental groups according to their received diet. The control group was fed with a complete feed mixture (CFM) without rapeseed meal addition, while the experimental group was fed with diet containing different amount of rapeseed meal (A1 = 5.0; A2 = 7.0 and CDP = 12.43%) during different stages of the fattening period. The addition of rapeseed meal to the diet significantly decreased the following parameters: loin colour - lightness L* (control group = 56.26 vs. experimental group = 51.58; $P = 0.001$), yellowness b* (control group = 10.62 vs. experimental group = 8.90; $P = 0.003$) and backfat tenderness (control group = 68.53 N vs. experimental group = 51.26 N; $P = 0.015$). In addition, rapeseed meal in the diet significantly increased the values of pH in ham (control group = 6.35 vs. experimental group = 6.55; $P = 0.008$). There were no other significant effects of the rapeseed meal addition observed. Along with this finding it can be concluded that rapeseed meal can be used in feeding mixtures for pigs without having any negative effects on the physical parameters of pork meat and fat quality.

Key Words: Rapeseed meal; pig; loin; ham; fat; physical characteristics

Pork meat traditionally holds the highest share in the consumption of meat in the Czech Republic. Among the most important parameters determining the meat quality are the physical properties of meat, which include pH, drip loss, colour and electrical conductivity. The overall quality of meat is influenced by many factors ranging from piglet rearing to the final mechanisms of meat processing. External factors determining the quality also include nutrition. The use of rapeseed meal addition in the diet of pigs seems to be very profitable. Rapeseed meal contains higher share of sulfur-containing amino acids and higher content of phosphorus, which can reduce the cost of mineral feed. It is stated that it is possible to incorporate up to 15% of rapeseed meal into the pig feeding mixtures. However based on the results published by Salo (1982), where the pigs were fed with feeding mixture containing 17% of rapeseed (i.e., 6.3 μmol glucosinolates/g of diet), there were no obvious negative effects of glucosinolates on the colour and flavour of the meat, or the stiffness of fat. Many authors (Corin *et al.*, 1991; McDonnell *et al.*, 2010) reported that rapeseed meal can be used in feeding mixtures for pigs with no deleterious effects on carcass characteristics. The aim of this study was to determine the overall effect of inclusion of rapeseed meal in the CFM on the physical parameters of meat and fat quality in pigs.

Material and Methods

Animals

The experiment was performed at the Experimental test station in Ploskov at Lány. A total amount of 72 (final crossbreeds of DanBred_(paternal) \times (Czech Large White_(maternal) \times Czech Landrace)) 69-day-old gilts and barrows

with an average live weight of 20.9 kg were included in the experiment. The rearing of the pigs was carried out in pairs according to the methodology published by Stupka *et al.* (2009), which was designed for testing purebred and hybrid pigs under standardized station conditions.

Diet

The pigs were fed with a complete feed mixture (CFM) containing three main components (wheat, barley and soybean meal) mixed together with premix. The diet was mixed separately for each pen in accordance with the above mentioned methodology. The nutrient composition of the CFM is shown in Table 1. The transition between CFM (groups A1, A2 and CDP) was carried out continuously during the test. The control group was fed with a CFM containing soybean meal (A1 = 17.7, A2 = 14.0 and CDP = 9.5%) and pigs from the experimental group were fed a diet enriched with the addition of rapeseed meal (A1 = 5.0, A2 = 7.0 and CDP = 12.43%). The pigs were fed *ad libitum*. At the end of the experiment, the pigs were slaughtered at an average live weight of 105 kg.

Qualitative characteristics of the carcass value

Qualitative carcass value characteristics were assessed in 40 pigs (20/20 – control/experimental group), in the following parts of meat: the cut between 13th and 14th rib in the loin (*musculus longissimus lumborum et thoracis*; MLLT) and the ham (*musculus semimembranosus* – MS). The pH₄₅ value was measured using a pH meter (pH 330i/set, WTW, Weilheim, Germany) equipped with pH-electrode (Sen Tix Sp, WTW, Weilheim, Germany) 45 minutes post-mortem, and electrical conductivity (conductometer – pigmeter, ČVUT, Prague, Czech Republic) was determined 50 minutes post-mortem (EC₅₀).

Meat and fat colour values (L^* , lightness; a^* , redness; b^* , yellowness) (CM-2500d spectrophotometer, Minolta, Osaka, Japan), as well as the shear force value of raw and cooked loin and fat (Instron 3342, USA) were measured together with drip loss 24 h post-mortem in accordance with the methodology published Rasmussen and Andersson (1996). The obtained samples were first stored for 24 h at 5°C and then assessed.

Statistical analysis

The results of the experiment were evaluated with the use of statistical program SAS[®] Propriety Software Release 6.04 (2001), using the analysis of variance program (ANOVA). The differences between individual monitored parameters were analyzed *via* t-test.

Results and Discussion

The results concerning physical characteristics of the loin and ham meat quality and backfat quality are shown in the Table 2. As it is evident based on the results of our observation, the addition of rapeseed meal in the diet did

in fact influence some of the monitored parameters. The experimental group (i.e. the group fed with the addition of rapeseed meal) showed a statistically significant increase in the pH₄₅ MS values. On the other hand the lightness (L^* ; $P = 0.001$), yellowness (b^* ; $P = 0.00$) and backfat tenderness (backfat 1; $P = 0.015$) parameters were significantly higher in the control group. Similar results were obtained in the study published by Warnantse *et al.* (1995), who following the addition of rapeseed meal into the diet of pigs observed backfat, that was more tender, thinner and slightly rosy in colour. Conversely, following the same experiment, Salo (1982) noted no effects on colour of meat and stiffness of fat whatsoever. Consistently with his finding, SiljanderRasi *et al.* (1996) showed that the addition of rapeseed meal had no significant effect on organoleptic quality of the meat (taste, tenderness and juiciness). In accordance with these findings Sobotka *et al.* (2012) found no significant effects of rapeseed meal on the physical characteristics of meat, with the exception of the colour of *M. longissimus dorsi*, which seemed to be the only parameter affected.

Table 1. Ingredients and nutrient composition of the individual diets ^a

| Ingredient (g/kg) | Control group | | | Experimental group | | |
|-----------------------------|---------------|-------|-------|--------------------|-------|-------|
| | A1 | A2 | CDP | A1 | A2 | CDP |
| Wheat | 440.0 | 400.0 | 378.0 | 413.2 | 453.6 | 536.2 |
| Barley | 353.0 | 432.0 | 500.0 | 300.0 | 300.0 | 300.0 |
| Soybean meal – 48 | 177.0 | 140.0 | 95.0 | 184.8 | 131.7 | 0.0 |
| Premix | 30.0 | 28.0 | 27.0 | 33.3 | 30.3 | 25.8 |
| Extruded rapeseed meal | - | - | - | 50.0 | 70.0 | 124.3 |
| Rapeseed oil | - | - | - | 18.7 | 14.4 | 13.7 |
| Nutrient composition | | | | | | |
| MEp by calculation (MJ/kg) | 12.9 | 12.8 | 12.7 | 13.1 | 13.0 | 12.9 |
| Crude protein | 180.0 | 165.1 | 147.4 | 186.8 | 173.1 | 138.7 |
| Crude fibre | 35.9 | 36.8 | 37.2 | 43.9 | 44.0 | 44.3 |
| Lysine | 10.7 | 9.6 | 8.3 | 12.0 | 11.0 | 8.5 |
| Methionine | 3.1 | 2.9 | 2.7 | 3.3 | 3.0 | 2.4 |
| Methionine + cysteine | 6.6 | 6.2 | 5.7 | 6.7 | 6.3 | 5.3 |
| Threonine | 6.7 | 6.1 | 5.4 | 7.8 | 7.1 | 5.5 |
| Tryptophan | 2.2 | 2.0 | 1.8 | 2.3 | 2.1 | 1.6 |
| Calcium | 7.1 | 6.6 | 6.3 | 7.5 | 7.0 | 6.0 |
| Phosphorus - digestible | 4.9 | 4.7 | 4.5 | 5.8 | 5.5 | 5.3 |
| Sodium | 1.8 | 1.7 | 1.6 | 1.9 | 1.7 | 1.5 |

^a - A1, A2 and CDP are types of mixed feeds, which were fed to pigs with average live weights of 28 to 35 kg, 35.1 to 60 kg and 60.1 to 110 kg, respectively.

Table 2. The effect of rapeseed meal on physical characteristics of meat and fat (mean \pm SD).

| Item | Control group | Experimental group | Significance |
|---|-------------------|--------------------|--------------|
| MLLT: pH ₄₅ value | 6.22 \pm 0.24 | 6.39 \pm 0.19 | ns |
| EC ₅₀ (mS) | 4.21 \pm 0.77 | 3.77 \pm 0.33 | ns |
| MS: pH ₄₅ value | 6.35 \pm 0.21 | 6.55 \pm 0.13 | 0.008 |
| EC ₅₀ (mS) | 3.91 \pm 0.53 | 3.78 \pm 0.44 | ns |
| Colour loin: lightness (<i>L</i> *) | 56.26 \pm 2.57 | 51.58 \pm 3.63 | 0.001 |
| redness (<i>a</i> *) | - 0.96 \pm 0.95 | - 1.20 \pm 0.85 | ns |
| yellowness (<i>b</i> *) | 10.62 \pm 1.16 | 8.90 \pm 1.42 | 0.003 |
| Colour backfat: lightness (<i>L</i> *) | 79.20 \pm 1.28 | 78.42 \pm 1.46 | ns |
| redness (<i>a</i> *) | - 0.45 \pm 0.53 | - 0.46 \pm 0.66 | ns |
| yellowness (<i>b</i> *) | 8.14 \pm 0.95 | 7.92 \pm 1.06 | ns |
| Tenderness (N): raw loin | 44.53 \pm 6.83 | 41.67 \pm 9.38 | ns |
| coked loin | 37.04 \pm 8.04 | 36.80 \pm 10.61 | ns |
| backfat 1 | 68.53 \pm 21.87 | 51.26 \pm 8.09 | 0.015 |
| backfat 2 | 46.15 \pm 14.33 | 38.05 \pm 10.15 | ns |
| Drip loss loin (%) | 6.94 \pm 2.62 | 5.55 \pm 3.17 | ns |

MLLT - *musculus longissimus lumborum et thoracis*, MS - *musculus semimembranosus*, ns - nonsignificantly; pH₄₅ - pH value measured 45 minutes post mortem; EV₅₀ - electrical conductivity, measured 50 minutes post mortem; L* - meat colour; a*, b* - colour tones; backfat 1 – measuring between the skin and the fascia; backfat 2 - measuring between the fascia and the meat = cut between 13th and 14th rib.

Conclusion

The inclusion of rapeseed meal in pig diet influenced some of the physical characteristics of the meat and fat quality. Fattened pigs from the experimental group had a darker meat and showed higher backfat tenderness. Based on the results obtained in this study, it is obvious that rapeseed meal can be fed to pigs without any negative effects on meat and fat quality, both of which were evaluated based on their main physical parameters.

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