Vitamin E and rapeseed oil in feed of pigs - influence on the quality of meat products

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Abstract

Vitamin E, added to feedstuff, has proven to have an antioxidative effect towards fresh pork. Improvements are seen in muscle and adipose tissue. Development of rancidity, drip loss and discoloration are retarded. Rapeseed oil in the diet is known to have an adverse effect to meat quality. The amount of unsaturated fatty acids in tissues is enhanced by rapeseed oil. Consequently fat will become soft and more susceptible to oxidation. Positive and negative effects in fresh pork can be balanced by dietary treatment. Which requirements regarding meat and fat quality are needed for production of raw, cured and smoked meat products? Raw sausages (salami type) and raw hams were manufactured and stored.

Materials and methods

Basis for the meat products were two feeding trials, described in the preceeding paper no. I. 'Influence on Animal Performance and Fresh Pork' by Honikel et al.. Raw sausages were produced as mixed batches of 2 resp. 3 animals of each group. Usual technological procedures were applied, with the exception that only pork (66 resp. 75 % shoulder) with a portion of 33 % belly resp. 25 % backfat was used. After 3 weeks of ripening the sausages had lost about 30 % of weight. The sausages were vacuum packaged and stored at 12 °C. After 12 and 26 weeks of storage the vitamin E-content was determined by a modification of the method of Brubacher et al. (1985). Sensory evaluation was done by a panel of 6 experienced people at the same intervals.

Raw hams were produced from frozen material. After the samples have been thawed at 1-2 °C, 3.5 % of nitrite curing salt (w/w) containing 0.5 % nitrite were added to each ham. Each portion of ham was packed separately in vacuum. The samples were tumbled for 24 hours (effective time of movement: 30 min) and cured for 3 weeks in the vacuum bag at 1-2 °C. After washing the surface, the hams were allowed to dry for 3 weeks at 5 °C and 85 % r.H.. Then the samples were smoked twice for 3 h. After 24 h of drying the hams were packaged separately in vacuum and stored at 12 °C. Ripening of these samples lasted for 9 weeks. Sensory evaluation was done directly after fermentation. Vitamin E-concentration was determined according to Pfalzgraf et al. (1995) after 6 month of frozen storage (-20 °C) under vacuum.

Results and discussion

All sausages and hams manufactured from meat with 6 % rapeseed oil were judged to be faulty products.

The qualitative defects of the sausages showed in formation of wrinkles, by loosing oil through the surface as well as by retarded drying. The products constantly showed a smeared cross section and soft and crumbly consistency. They were oily and pungent in the taste. The control group lost water at a faster rate than the ones with rapeseed oil.

Concerning the sensory evaluation of hams no big differences could be recognised between the supplemented groups. The raw hams were visually and analytically (content of nitrite, nitrate and salt) attractive, but only the control group exhibited the characteristic curing flavour. In each ham made of animals, which maintained 6 % rapeseed oil in the ration, the curing flavour was covered up by the deviating fat condition.

With increasing vitamin E-supplementation in feed there was an increase in vitamin E-concentration in all products. It became obvious that the feeding regime using a higher portion of unsaturated fatty acids (6 % rapeseed oil), despite an increased vitamin E-concentration, had a strong negative impact on raw and cured meat products.

After the feeding regime was changed to 2 % rapeseed oil, improvements were noticed in fat quality. Due to the lower level of unsaturates in the fat, its consistency was obviously improved. Fat did not smear during the production of sausage. Weight loss was accelerated and improved the fermentation of raw sausages. Neither vitamin E nor rapeseed oil did influence the weight loss of raw sausages during fermentation. These findings also corresponded to the a_w-level and the pH-level.

Vitamin E-levels in raw sausages during fermentation and storage corresponded very well to the levels supplemented in feed (fig. 1). Vitamin E-levels were found to increase when rapeseed oil and vitamin E was added to feed. The decrease of vitamin E-levels during storage was lower in the groups with additional rapeseed oil. Sensory evaluation of the sausages clearly indicated quality losses by addition of rapeseed oil to feed (fig. 2). Deductions were made for lacks in appearance, colour, consistency and taste. Faults were weighed differently: appearance (x1), colour (x1), consistency (x3), taste (x5) and other faults (x1). Enhanced vitamin E-concentrations (feed with 200 ppm) in the product could lower the quality defects to the level of the control group.

Vitamin E-levels in raw hams, both in muscle and adipose tissue, rose with increasing addition of vitamin E to feed (fig. 3). Supplementation with rapeseed oil enhanced the deposition of vitamin E in both types of tissue. Sensory evaluation was performed the same way as in raw sausages with equal weighing of faults (fig. 4). The addition of rapeseed oil to feed caused losses in sensory quality of raw hams. Increased vitamin E-concentrations in the product could lessen the faults to some extent, but could not make them up.

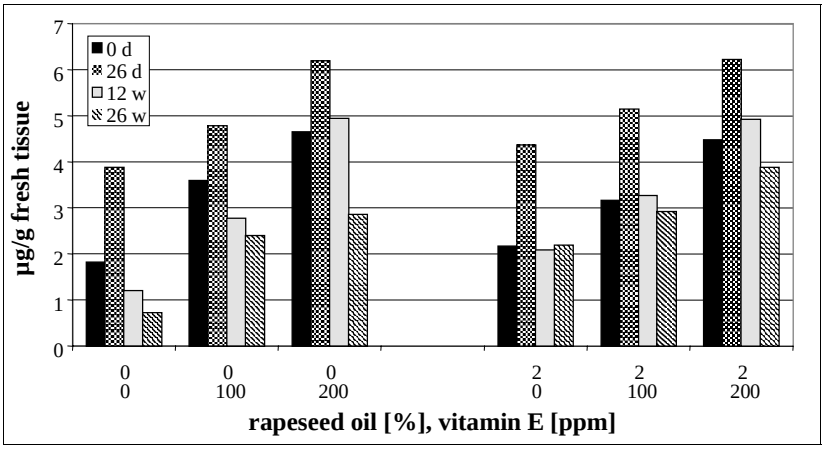

fig. 1: Vitamin E-level in raw sausages during fermentation and storage (mixed samples of 2 pigs)

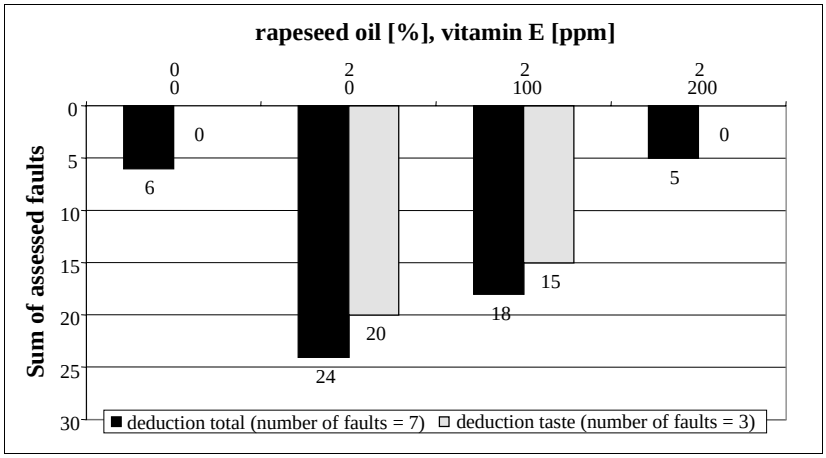

fig. 2: Sensory evaluation of raw sausages after 3 weeks of fermentation and 16 weeks of storage

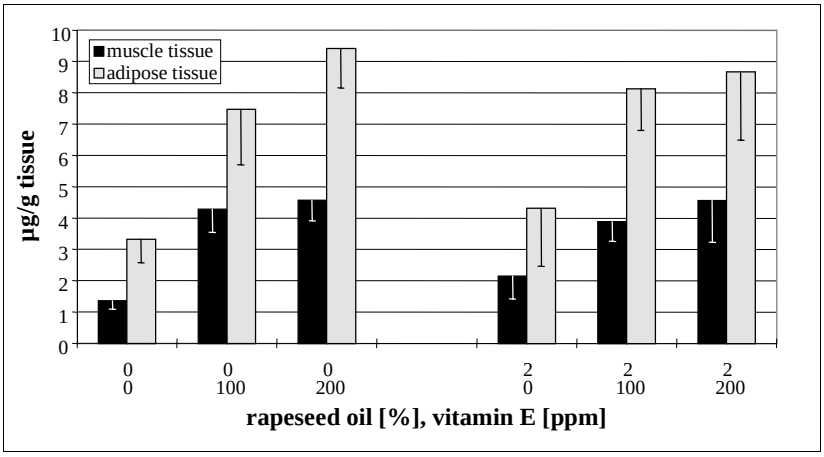

fig. 3: Vitamin E-level in raw hams after 9 weeks of fermentation (6 month frozen prior to analysis, n=5, mean - SD)

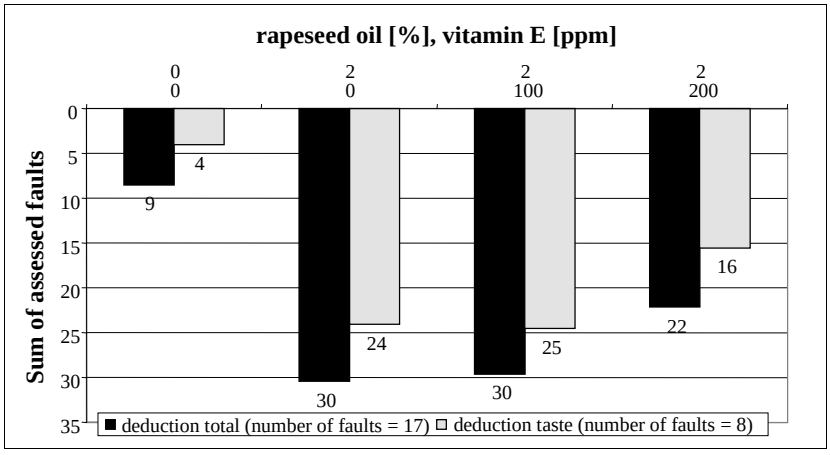

fig. 4: Sensory evaluation of raw hams after 9 weeks of fermentation (n=5)

Conclusions

The addition of 6 % rapeseed oil to feed caused severe quality deteriorations both in raw fat and muscle and in processed meat. This negative treatment effect could be lessened to some extent by increased levels of vitamin E in feed. Even high vitamin E-doses could not overcome the problems accompanied by the addition of 6 % rapeseed oil to feed. All of the sausages and hams manufactured from meat with 6 % rapeseed oil were judged to be faulty products.

Supplementation of feed with 2 % rapeseed oil resulted in improved fat quality. Neither vitamin E nor rapeseed oil showed treatment effects regarding the fermentation of raw sausages and hams. Enhancement of vitamin E in the diet caused increased vitamin E-concentrations in raw sausages and hams. Additional rapeseed oil increased vitamin E-levels in products, too.

Even 2 % rapeseed oil in the diet caused quality losses in the products evaluated by a sensory panel. Increased vitamin E-concentrations in the products could balance the negative treatment effects by rapeseed oil to some extent.

Feed supplemented with rapeseed oil (2 resp. 6 %) caused quality lacks in raw and cured meat products. Dietary vitamin E improved the quality, but could not completely make up the losses caused by rapeseed oil.

References

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Pfalzgraf, A., H. Steinhart and M. Frigg (1995), Rapid determination of α-tocopherol in muscle and adipose tissues of pork, Z. Lebensm. Unters.-Forsch. 200, p. 190 – 193.