EFFECT OF LINSEED IN PIG DIET ON FATTY ACID CONTENT IN BACKFAT OF PRESTICE BLACK-PIED PIGS

Václavková E., Bělková J., Rozkot M.

Institute of Animal Science Prague, Czech Republic

Abstract

The aim of the study was to evaluate the effect of linseed in diet of fattening Prestice Black-Pied pigs on fatty acid composition in their backfat. Sixteen Prestice Black-Pied pigs were divided into two groups and fed control diet (group C) and diet with 7 % of linseed addition (group L). The experiment started three months before slaughter. The intake of feed mixture and water was *ad libitum*. The average final live weight was 114.13 ± 10.09 kg (C group) and 110.00 ± 9.46 kg (L group). The content of total saturated fatty acid was not significantly influenced by the diet ($P>0.05$). Dietary supplementation with linseed significantly increased proportion of linolenic acid in backfat fatty acids ($P<0.05$). The total polyunsaturated fatty acid proportion was also significantly affected by the linseed diet (14.34 ± 3.09 rel. % in C group, 15.76 ± 2.14 rel. % in L group). The content of ω6 and ω3 polyunsaturated fatty acid was significantly increased by the linseed diet ($P<0.05$). Also ω6/ω3 PUFA ratio was significantly influenced by the diet.

Key Words: Přeštice Black Pied pig, linseed, backfat, fatty acid

Přeštice Black-Pied pig is Czech national breed. The importance of this breed lies in its good reproduction performance, adaptability, good vitality and resistance to diseases (Lustykova et al., 2008). The breed is characterised by higher backfat thickness and very good meat quality.

Pork meat is generally recognised as a food with relevant nutritional properties because of its high content in proteins of high biological value, rich in essential amino acids, as well as group B vitamins, minerals especially heme iron, trace elements and other bioactive compounds. But pork meat also contributes to the intake of fat, saturated fatty acids, cholesterol, and other substances that, in inappropriate amounts, may result in negative physiologically effects (Reig et al., 2013). The quality of meat and fat is influenced by many factors ranging from piglet rearing to the final mechanisms of meat processing. External factors determining the quality also include nutrition. Fatty acid composition of pork can be easily manipulated through the feeding regime (De Smet et al.,2004). The components with higher proportion of n -3 fatty acids must be added to feed in order to change fatty acid profile in meat and fat. In pig diet, an emphasis is laid on the omega-3 fatty acids in fish oil and vegetable oils (soy, olive, linseed, sunflower and rapeseed). Feeding sources rich in n-3 PUFA, such as rapeseed oil and especially crushed linseed have been shown to increase the n-3 PUFA content in intramuscular fat (Legrant et al.,2002; Wood et.al.,2004; Václavková et al., 2007) and reduce the n-6:n-3 ratio.

Material and Methods

Sixteen Prestice Black-Pied pigs were divided into two groups and fed control diet (group C) and diet with 7 % of linseed addition (group L). The control feed mixture was characterized by 2.81 rel. % of ω-3 polyunsaturated fatty acids (PUFA) and ω6/ω3 PUFA ratio 9.39. In experimental feed mixture was determined 12.06 rel. % of omega 3 PUFA and ω6/ω3 PUFA ratio 2.78. The experiment started three months before slaughter. The intake of feed mixture and water was *ad libitum*. The average initial live weight was 73.88 ± 8.49 kg in C group and 71.75 ± 8.14 kg in L group, average final live weight was 114.13 ± 10.09 kg (C group) and 110.00 ± 9.46 kg (L group).The samples of backfat were collected 24 h post mortem. Fatty acid composition of backfat was determined after chloroform-methanol extraction of total lipids (Folch et al., 1957). Alkaline trans-methylation of fatty acids was performed as described by Raes et al. (2003). Gas chromatography of methyl esters was carried out using an Agilent 6890M chromatograph (Agilent Technologies, Inc. local distributor HPST, Ltd., Prague 4, Czech Republic).

The statistical evaluation was performed using the computer program QCExpert (TriloByte Statistical Software Ltd.). Data were presented as the mean, standard deviation (SD) of each group and the significance levels.

Results and Discussion

The results of the experiment are illustrated in Table 1.

The proportion of palmitic acid was slightly decreased in the experimental group (22.30 ± 1.16 rel. %) compared with control group (23.02 ± 0.36 rel. %). On the contrary, stearic acid content was found higher in in L group (15.81 ± 1.35 rel %) than in C group (14.99 ± 0.57 rel. %). The content of total saturated fatty acid was not significantly influenced by the diet (P>0.05). Dietary supplementation with linseed significantly increased proportion of linolenic acid in backfat fatty acids (P<0.05). The total polyunsaturated fatty acid proportion was also significantly affected (14.34 ± 3.09 rel. % in C group, 15.76 ± 2.14 rel. % in L group) by the linseed diet (Figure 1). The content of ω6 and ω3 polyunsaturated fatty acid (Figure 2) was significantly increased by the linseed diet (P<0.05).

The ω6/ω3 PUFA ratio was also significantly influenced by the diet. The ratio was decreased from 6.77 to 5.67 (Figure 3). Enser et al. (2000) compared two diets with different content of linoleic and α-linolenic acid (their ratio in control diet was 11.1, in diet with linseed addition 2:1). They found the higher deposition α-linolenic acid in meat and fat in experimental group. The content of EPA in fat was not influenced by the linseed diet; on the other hand DHA proportion was increased. According Pascual et al. (2007), linseed addition to feed mixture has positive effect on linoleic acid deposition in fat tissue. Nuernberg et al. (2005) used linseed oil (5 % in feed mixture) to affect fatty acid proportion in muscle and fat tissue. The content of linoliec acid was significantly higher in group fed by the diet with linseed oil, on the other hand, the saturated fatty acids were not influenced. The ω6/ω3 ratio was significantly decreased.

Figure 1. The content of total saturated (SFA), monounsaturated (MUFA) and polyunsaturated (PUFA) fatty acid in backfat of pigs of control and experimental group

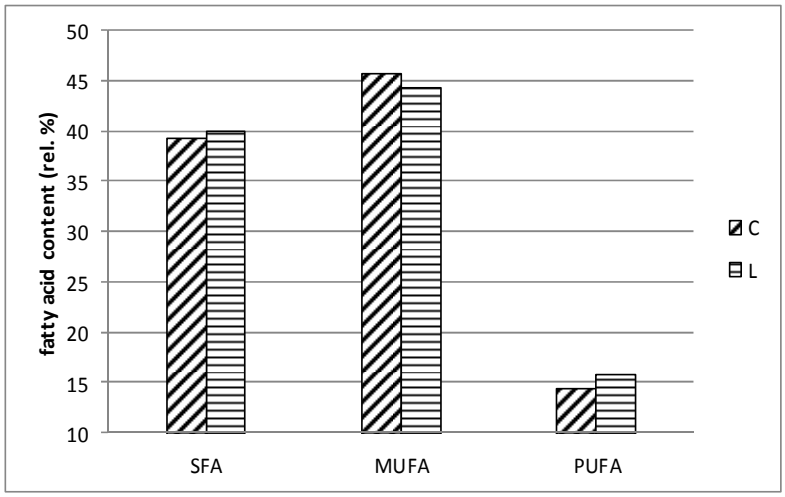


Figure 2. The content of ω6 and ω3 PUFA in backfat of pigs of control and experimental group

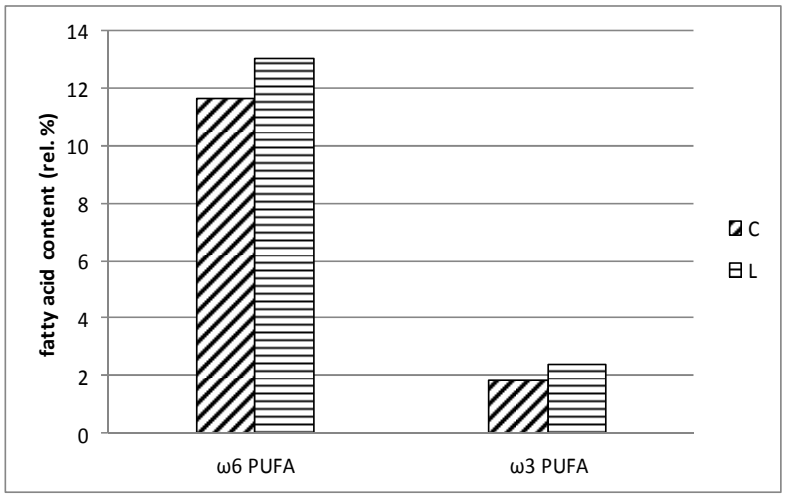
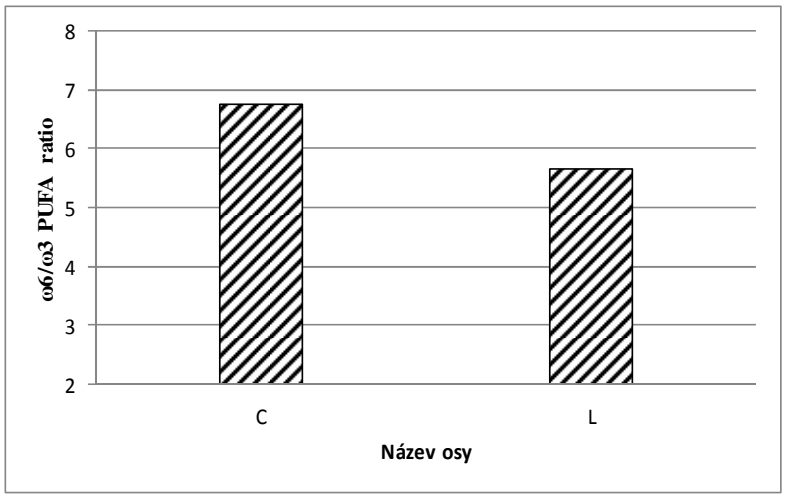


Table 1. Fatty acid proportion in backfat of pigs in control (C) and experimental group (L)

Fatty acid	Group	
	C	L
Myristic C14:0	1.07 ± 0.05	1.03 ± 0.09
Palmitic C16:0	23.02 ± 0.36	22.30 ± 1.16
Stearic C18:0	14.99 ± 0.57	15.81 ± 1.35
Oleic C18:1n9	40.53 ± 2.26	39.36 ± 1.11
Linoleic C18:2n6	10.64 ± 1.66[a]	11.93 ± 1.73[a]
alpha-linolenic C18:3n3	1.46 ± 0.74	1.85 ± 0.44
Arachidonic C20:4n6	0.28 ± 0.05	0.26 ± 0.07
EPA C20:5n3	0.04 ± 0.01	0.05 ± 0.006
DHA C22:6n3	0.01 ± 0.004	0.01 ± 0.004
SFA	39.93 ± 0.88	39.97 ± 2.51
MUFA	45.74 ± 2.53	44.28 ± 1.08
PUFA	14.34 ± 3.09[a]	15.76 ± 2.14[a]
ω6 PUFA	11.65 ± 1.57[a]	13.04 ± 1.71[a]
ω3 PUFA	1.87 ± 0.73[a]	2.38 ± 0.50[a]
ω6/ω3 PUFA	6.77[a]	5.67[a]

SFA-saturated fatty acids, MUFA-monounsaturated fatty acids, PUFA-polyunsaturated fatty acids
Values in the same row sharing the same superscripts differ significantly at $P < 0.05$

Figure 3. The ratio of ω6 and ω3 PUFA in backfat of pigs of control and experimental group



Conclusion

The linseed addition to feed mixture for fattening Přeštice Black-Pied pigs significantly influenced linoleic acid and total polyunsaturated fatty acid content in backfat, also ω6/ω3 ratio was significantly affected by the linseed diet. The proportion of saturated and monounsaturated fatty acids was not influenced.

References

Enser M., Richardson R., Wood J. D., Gill B. P., Sheard P. R., 2000: Feeding linseed to increase the n-3 PUFA of pork: fatty acid composition of muscle, adipose tissue, liver and sausages. *Meat Science* 55: 201-212.

Folch J.M., Lees M., Sloane-Stanley G.H., 1957. A simple method for the isolation and purification of total lipids from animal tissues. *J. Biol. Chem.* 226, 497-509.

Legrand, P., &Mourot, J. (2002). Le point sur les apportsnutritionnelsconseillés en acidesgras, implicationsur les lipides de la viande. 9èmes Journées des SciencesduMuscle et Technologies de la Viande. 15–16 October, Clermont-Ferrand, France.

Lustyková A., Frydrychová S., Lipenský J., Vejnar J., Rozkot M. 2008). Practical aspects of porcine semen collection for conservation and utilization of farm animal genetic resources. *Research in Pig Breeding*, 2:22-25.

Nuernberg K., Fischer K., Nuernberg G., Kuchenmeister U., Klosowska D., Eliminowska-Wenda G., Fiedler I., Ender K., 2005: Effects of dietary olive and linseed oil on lipid composition, meat quality, sensory characteristics and muscle structure in pigs. *Meat Science*, 70:63-74.

Pascual J. V., Rafecas M., Canela M. A., Boatella J., Bou R., Barroeta A. C., Codony R., 2007: Effect of increasing amounts of a linoleic-rich dietary fat on the fat composition of four pig breeds. Part II: fatty acid composition in muscle and fat tissues. *Food Chemistry*, 100: 1639-1648.

Raes K., De Smet S., Balcaen A., Claeys E., Demeyer D., 2003. Effect of diets rich in N-3 polyunsaturated fatty acids in Belgian Blue double-musculed young bulls. *Reprod. Nutr. Dev*. 43, 331-345

Reig M, Aristoy M-C., Toldrá F. (2013). Variability in the contents of pork meat nutrients and how it may affect food composition databases. *Food Chemistry*, 140:478-482.

Václavková, E., Bečková, R. 2007, Essential fatty acid content in meat and backfat of pigs fed linseed diet. *Research in Pig Breeding*, roč. 1, č. 2, s. 26-28.

Wood, J. D., G. R. Nute, R. I. Richardson, F. M. Whittington, O. Southwood, G. Plastow, R. Mansbridge, N. da Costa, and K. C. Chang. 2004. Effectofbreed, diet and muscle on fat deposition and eatingquality in pigs. *Meat Science,* 67:651–667.

Corresponding Address:
Ing. Eva Václavková, Ph.D.
Institute of Animal Science Prague
Department of Pig Breeding
Komenského 1239, 51741 Kostelec nad Orlicí
Czech Republic
Email:vaclavkova.eva@vuzv.cz

This study was supported by the Ministry of Agriculture of the Czech Republic – research project NAZV QJ1210253.