ESSENTIAL FATTY ACID CONTENT IN MEAT AND BACKFAT OF PIGS FED LINSEED DIET

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Abstract

The objective of this experiment was to find way of essential fatty acid content changing. Thirty cross breed gilts was divided in two groups and fed with control or linseed diet. The fatty acid composition was measured in samples of muscle tissue and in backfat. The statistical significant differences in fatty acid content were found. Linoleic and alpha-linolenic acid content was increased.

Introduction

Generally, fatty acids are very important for human health. Alpha linolenic acid (18:3n-3) is the precursor fatty acid for the synthesis of eicosapentaenoic acid (EPA, 20:5n-3) and docosahexaenoic acid (DHA, 22:6n-3). Changing the pigs´ diet provides an effective method of changing the fatty acid composition of pig fat depots, thereby modifying the human dietary fat intake from pork (Wood, Enser,1997). The level of food intake and composition of food regulates the rate of fatty tissue growth and the composition of lipids. There is a correlation between the amount of fatty tissue and fatty acid composition. The potential for dietary variation of lipid composition in monogastric animals is much greater then in ruminants (Nürnberg et al., 1998).

There is possibility to change the fatty acid content in pork meat and backfat via diet. Fontanillas et al. (1998) describe evolution of backfat fatty acid content in pigs fed linseed oil diet. Alpha linolenic acid content showed an exponential increase. Linseed diet caused a linear decrease in n-6 fatty acid content. In experiment performed by Enser et al. (2000) were 80 pigs fed a control or test diet (with added linseed). Levels of alpha-linolenic, EPA and DHA in muscle and adipose tissue was increased. Also Kouba et al. (2003) came to the similar conclusion. Feeding the linseed diet increased the content of n-3 PUFA in muscle and adipose tissue but DHA content was not altered by diet.

Linoleic acid is the component of cell membranes, plays special role in immune system and creation of prostaglandine.

But over-supply can cause cardiovascular diseases, cholesterol deposition in body and support of inflammation. Alpha-linolenic acid decreases cholesterol content and it is precursor of DHA and EPA and prevention of sudden cardiac deaths (Kang et al.,2000; Pompeia et al., 2000; Demaison et al., 2002; Leaf et al., 2003).

Material and methods

Thirty crossbreed gilts (Czech Large White x Czech Landrace) x (Hampshire x Pietrain) were divided in 2 groups – control (feeding mixture without linseed) and experimental (feeding mixture with 13,4% ground linseed).

The experiment was started at average live weight 38,5 ± 5,4 kg and it was finished at average weight 88,5 ± 8,5 kg. Feed and water intake was ad libitum. Animals were slaughtered in experimental slaughterhouse and than (24 hours post mortem) the samples of muscle and backfat tissue were collected and frozen in PE bags. Laboratory analysis of fatty acid content was carried out by method of gas chromatography according Folch et al. (1957), CSN ISO 5509 and CSN ISO 5508. The statistical evaluation was performed using the computer program QCExpert (t-test).

Results and discussion

Linseed diet affected essential fatty acid composition in muscle tissue and in backfat. In connection with this changes were EPA and DHA content modified too (Table 1 and 2, Figure 1 and 2).

Table 1.: Fatty acid content in muscle tissue (g/100g of total fatty acids)

Fatty acid	Control group	Experimental group	t-test
Linoleic C18:2n-6	9.51 ± 1.99	11.24 ± 2.53	*
α-linolenic C18:3n-3	0.44 ± 0.09	2.27 ± 0.41	***
Arachidonic C20:4n-6	3.08 ± 0.69	2.63 ± 0.72	-
EPA C20:5n-3	0.02 ± 0.02	0.04 ± 0.04	-
DHA C22:6n-3	0.12 ± 0.04	0.14 ± 0.06	-

*P<0,05 **P<0,01 ***P<0,001

Table 2.: Fatty acid content in backfat (g/100 g of total fatty acids)

Fatty acid	Control group	Experimental group	t-test
Linoleic C18:2n-6	9.18 ± 1.48	10.87 ± 1.29	**
α-linolenic C18:3n-3	0.87 ± 0.20	4.90 ± 0.79	***
Arachidonic C20:4n-6	0.21 ± 0.04	0.17 ± 0.03	**
EPA C20:5n-3	0.01 ± 0.01	0.02 ± 0.02	-
DHA C22:6n-3	0.02 ± 0,01	0.04 ± 0,01	**

*P<0,05 **P<0,01 ***P<0,001

Figure 1.: Fatty acid content in muscle tissue (g/100g of total fatty acids

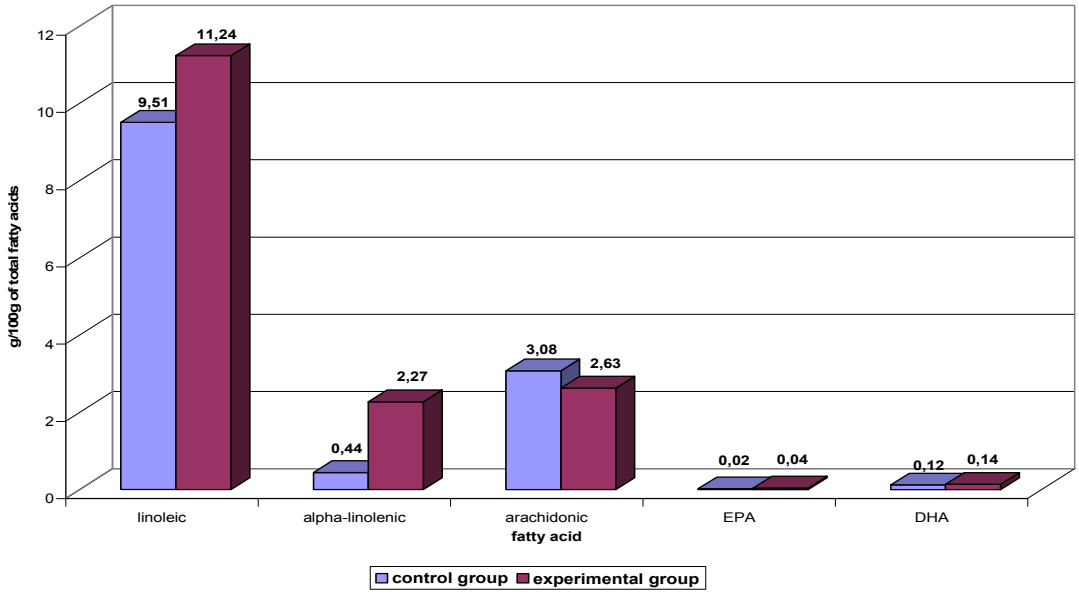
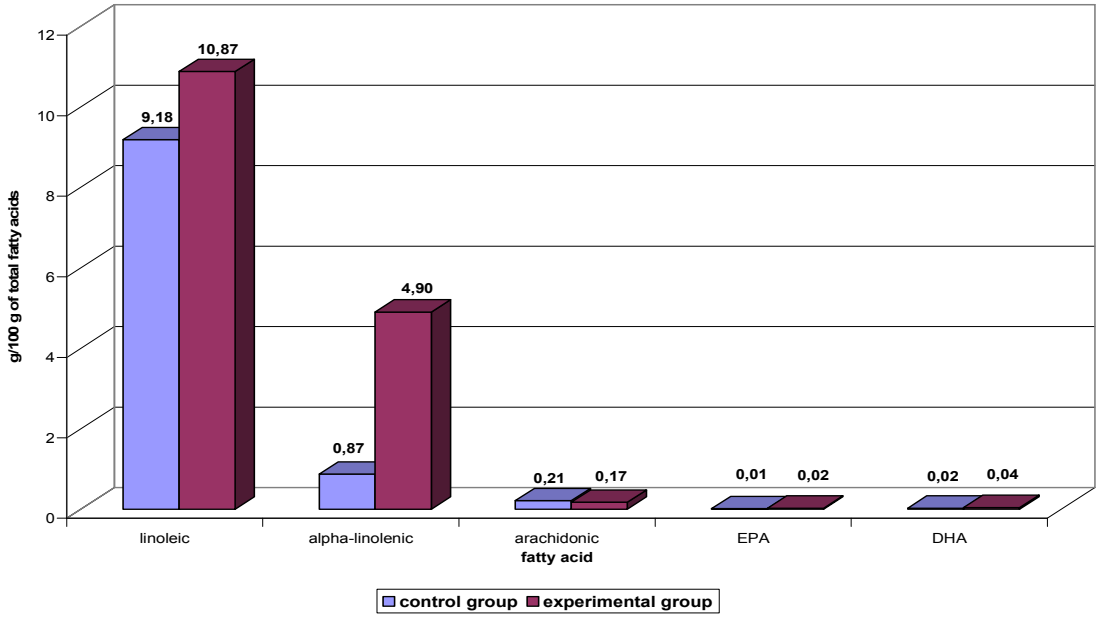


Figure 2.: Fatty acid content in backfat (g/100 g of total fatty acids)



There was a statistical significant difference in fatty acid content in muscle tissue. Linoleic acid was increased from 9,51 ± 1,99 g/100 g to 11,24 ± 2,53 g/100g (P<0,05), alpha-linolenic acid content was increased on high significance level from 0,44 ± 0,09 to 2,27 ± 0,41 g/100 g (P<0,001). It means about 550% increase. But arachidonic acid, EPA and DHA content was not affected by linseed diet. The effect of linseed oil and olive oil on lipid composition was mentioned in a study by Nuernberg et al. (2005). Feeding linseed oil to pigs significantly increased the relative content of linolenic acid. Hoz et al. (2003) studied influence of linseed-rich test diet on meat quality. The test diet resulted in higher α-linolenic acid levels, with major increases in total n-3 PUFA content. We observed this increase in α-linolenic acid content as well.
The statistical significant increase in linoleic (P<0,01), alpha-linolenic acid (P<0,001) content was observed in backfat. Arachidonic acid and DHA content was changed too. There was found out decrease in arachidonic acid (from 0,21 ± 0,04 to 0,17 ± 0,03 g/100 g; P<0,01). It corresponds with recommendation of many authors that n-6 fatty acid content should be reduced and n-3 fatty acids should be enhanced (Weill et al., 2002).

Conclusion

The content of essential fatty acids and selected polyunsaturated fatty acids was monitored in our experiment. There is possibility to change fatty acid profile via linseed diet in porcine muscle tissue and in backfat.

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