

A note on the effect of feeding different fats during the growing period on the final fatty acid composition of back fat in pigs

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ABSTRACT

Groups of 20 growing Large White castrated males were fed from 30 to 60 kg liveweight on diets containing different kinds of added fat: animal fat (group II), rape seed oil (III) and fat with 15 (group IV) or 20% (group V) unsaturated fatty acids (EUFA) content, and control group (I) without supplement. During the fattening period from 60 to 100 kg liveweight all the pigs were fed on the same mixture without fat supplementation.

The use of fat additives containing high levels of EUFA (groups III, IV and V) increased the linolic acid content in back fat of fatteners slaughtered at 100 kg liveweight.

KEY WORDS: fat supplement, fatty acids, back fat, pigs

INTRODUCTION

Fat added to rations increases their energy value and may be also a source of essential unsaturated fatty acids (EUFA). The requirement of young pigs for EUFA is relatively high and equals, according to Migdał and Kaczmarczyk (1985) 2-3% of the digestible energy of the ration, while according to other authors (Christensen-Jakobsen, 1985), at least 0.2% of the gross energy content of the diet for pigs between 10 and 100 kg of body weight.

The composition of the diet, especially the quality of the added fat, can be a factor modifying the fatty acid composition of the storage fat of pigs. Feeding the diets containing fats with high levels of EUFA (vegetable or standardized fats) leads to increased EUFA deposition in back fat, while increased intake of

saturated fatty acids (e.g., from animal fat) is not accompanied by their increased deposition (Oslage, 1984; Ziółkowski et al., 1994). A higher EUFA concentration in back fat is a favourable trait from the point of view of dietetic value for humans, but it lowers its quality as a raw material for processing.

The objective of the study was to examine the effect of fats with various fatty acid profiles added to rations during the growing period, i.e. up to 60 kg liveweight of pigs, on the fatty acid composition of back fat at the end of fattening.

MATERIAL AND METHODS

The experiment was conducted on 100 Large White castrated males divided into 5 groups of 20 animals each, fed individually. The animals were fattened from 30 to 100 kg liveweight. During the growing period from 30 to 60 kg, the animals received the feed mixtures composed as given in Table 2. The control group (I) was fed a mixture with no added fat, while the animals in the experimental groups received the diets containing the following fat supplementation:

- group II – technical animal fat,
- group III – double low rape seed oil with low erucic fatty acid content,
- group IV – fat with a 15% EUFA content (TW-15),
- group V – fat with a 10% EUFA content (TW-10).

TW-15 and TW-10 fats were standardized by mixing fats with previously determined fatty acid composition (Table 1). The basic components were technical animal fat and rape seed oil used as fat additives in groups II and III. The proportions of the fats in TW-15 and TW-10 were determined on the basis of their fatty acid composition (Table 1).

TABLE 1

Composition of fat mixtures

Item	Content, %	
	TW-10	TW-15
Lauric and myristic acids	max – 5	max – 5
Palmitic and stearic acids	max – 30	max – 25
Linolic and linolenic acids	min – 10	min – 15
Unsaturated acids	max – 30	max – 30
Acids with 20 or more carbons in chain	max – 5	max – 5

TABLE 2

The chemical composition of feed mixtures, %

Item	30 to 60 kg liveweight					60 to 100 kg liveweight
	G R O U P S					
	I	II	III	IV	V	
Ground barley	64.0	64.0	64.0	64.0	64.0	70.5
Ground wheat	20.0	14.0	14.0	14.0	14.0	20.0
Soyabean oilmeal	9.0	10.5	10.5	10.5	10.5	3.0
Animal meal	3.0	3.0	3.0	3.0	3.0	2.0
Fodder yeast	1.0	1.0	1.0	1.0	1.0	1.0
Technical animal fat	—	4.5	—	—	—	—
Rape seed oil	—	—	4.5	—	—	—
Fat, 15 % EUFA	—	—	—	4.5	—	—
Fat, 10 % EUFA	—	—	—	—	4.5	—
Limestone	0.6	0.6	0.6	0.6	0.6	0.7
Feed-grade phosphate	1.5	1.5	1.5	1.5	1.5	1.9
NaCl	0.4	0.4	0.4	0.4	0.4	0.4
Vitamin mineral premix	0.5	0.5	0.5	0.5	0.5	0.5
Dry matter	91.1	91.9	92.6	93.2	93.3	91.9
Crude protein	16.3	16.3	16.2	16.2	16.0	13.9
Crude fat	2.2	6.9	6.9	6.9	7.0	2.3
Crude fibre	4.8	4.4	4.5	4.4	4.6	6.5
Crude ash	5.2	5.8	6.1	5.9	6.1	5.9
ME MJ/kg	12.5	13.3	13.5	13.8	13.9	12.4
Fatty acids:						
palmitic	0.35	1.44	0.41	1.27	1.37	
stearic	0.05	0.67	0.25	0.35	0.45	
oleic	0.43	1.68	2.53	1.75	1.98	
linolic	0.91	1.17	1.84	1.40	1.14	
linolenic	0.12	0.25	0.62	0.58	0.49	

During the fattening period from 60 to 100 kg, all the pigs were fed on the same mixture with no added fat. Composition of diets is given in Table 2. The experiment was ended by slaughtering 5 animals from each group. Dressing percentage, back fat thickness over the last thoracic vertebra and loin eye area were determined. The fatty acid composition was determined in appear and lower layer of back fat samples taken from the sites where thickness was measured. Chemical analyses were carried out using conventional methods. The fatty acid composition of the feed and back fat lipid fractions was determined by gas chromatography of methyl esters.

Two factorials analysis of variance of the main fatty acids content in outside and inside layers of back fat was carried out. Significance of differences between mean values was checked with Duncan test. Dressing percentage, back fat

thickness and loin eye area were submitted to one factorial analysis of variance and Duncan test.

RESULTS AND DISCUSSION

The addition of fats to the feed mixtures offered to the experimental animals increased the crude fat content from 2.2 to about 7.0% and metabolizable energy content from 12.5 to 13.3-13.9 MJ/kg (Table 2). It also led to differences in the fatty acid composition of the lipid fraction. The mixtures supplemented with double low rape seed oil and standardized fats contained, as expected, more unsaturated fatty acids (UFA), especially linolic and linolenic acids (EUFA) compared to the mixture with animal fat and control mixture with no added fats (Table 2). The mixture with animal fat fed to group II contained the greatest amount of saturated fatty acids (stearic and palmitic acids), while the mixture with rape seed oil contained mostly unsaturated acids (oleic, linolic and linolenic acids). In effect the intake of particular fatty acids by the animals in the experimental groups varied.

The added fats did not significantly affect the carcass dressing percentage

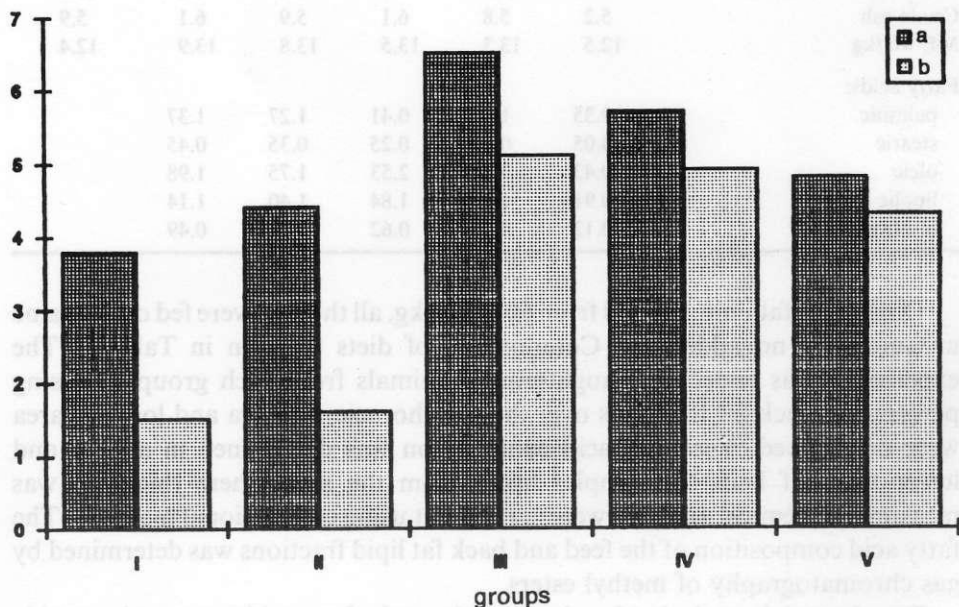


Figure 1. a. Linolic acid intake by pigs in the growing period from 30 to 60 kg liveweight, g/kg gain
b. The proportion of linolic acid in total fatty acids of back fat, %

TABLE 3

Dressing percentage and fatty acids contents in back fat

Fatty acids	G R O U P S				
	I	II	III	IV	V
Proportion in total, %					
Palmitic C16 : 0					
O ¹	30.07 ^A	29.27	26.15	25.82	25.17
I ²	28.27 ^B	29.90	26.76	25.88	26.41
O+I	29.17 ^a	29.59 ^a	26.46 ^b	25.85 ^c	25.79 ^c
Stearic C18 : 0					
O	16.97	16.71	15.61	14.20 ^b	11.87 ^b
I	17.58	17.85	15.78	16.72 ^a	14.48 ^a
O+I	17.28 ^a	17.29 ^a	15.69 ^a	15.45 ^a	13.17 ^b
Oleic C18 : 1					
O	41.49	40.98	43.41 ^a	45.48 ^a	49.26 ^a
I	39.89	41.02	41.30 ^b	42.34 ^b	45.78 ^b
O+I	40.69 ^b	41.00 ^b	42.35 ^b	43.91 ^b	47.52 ^a
Linolic C18 : 2					
O	0.83 ^B	1.16 ^A	3.55 ^A	3.58 ^A	3.39 ^A
I	2.18 ^A	1.86 ^B	6.57 ^B	6.02 ^B	5.09 ^B
O+I	1.51 ^B	1.51 ^B	5.06 ^A	4.80 ^A	4.24 ^A
Linolenic C18 : 3					
O	0.54	0.47	0.67 ^b	0.59	0.52
I	0.62	0.56	1.22 ^a	0.52	0.56
O+I	0.58 ^b	0.52 ^b	0.94 ^a	0.55 ^b	0.53 ^b
Dressing percentage, %	72.0 ^b	74.7 ^a	72.2 ^b	72.5 ^b	71.4 ^b
Back fat thickness, cm	2.10	2.30	1.72	2.10	2.16
Loin eye area, cm ²	32.42	34.20	35.96	34.66	33.88

¹ outside layer of back fat² inside layer of back fat

a, b - P ≤ 0.05; A, B - P ≤ 0.01

(Table 3), which ranged from 71.4 to 74.7%. The differences among the groups in mean back fat thickness and loin eye area were also insignificant.

The fatty acid composition of the feeds fed during growing period did, however, change the fatty acid composition of back fat at slaughter, in spite of the fact that during the fattening period all the pigs were given feed with no added fat. The fatty acid composition of the back fat of pigs receiving animal fat (group II) did not differ significantly from that of the control group. The back fat of animals receiving polyunsaturated fats (rape seed oil, TW-15, TW-10) was richer in EUFA and contained less palmitic and stearic acids (≤ P0.05). These results confirm the reports of Oslage et al. (1984) and Papadopulos and Panaopulou

(1988) about the positive correlation between the linolic and linolenic acid contents in feeds and their content in back fat. The addition of rape seed oil and standardized fats increased the up take of linolic acid by the pigs. The rise in linolic acid up take per kilogram body weight gain in the growing period was accompanied by its greater content in back fat after slaughter (Figure 1).

Differences in fatty acid composition were found in the upper and lower layers of back fat. It should be stressed here that in every feeding variant, the inside layer of fat contained more linolic acid, while in those animals that received rape seed oil (group III), also more linolenic acid. The inside layer of fat in fatteners receiving the standardized fats, TW-15 (group IV) and TW-10 (group V) and rape seed oil (group III) contained significantly less oleic acid than the outside layer. It was also found that the inside layer of back fat contained a higher, although not always significantly so, stearic acid content in comparison with the outside layer. These results confirm the earlier results of Malmfors et al. (1978).

In agreement with Madsen and Staun (1990) it can be accepted that the dietary quality and value of the product can be affected by the composition of the ration fed to fattening pigs.

CONCLUSIONS

The fatty acid composition of a ration with a 4.5% addition of fat fed to pigs from 30 to 60 kg liveweight affected the fatty acid profile of back fat after slaughter, at 100 kg liveweight.

The use of fat additives containing high levels of EUFA, i.e. rape seed oil, TW-10 and TW-15, increased the linolic acid content in back fat.

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STRESZCZENIE

Wpływ rodzaju dodatków tłuszczowych do mieszanek paszowych skarmianych w pierwszym okresie tuczu na skład kwasów tłuszczowych słoniny

Sto wieprzków, podzielonych na 5 grup po 20, żywiono : w pierwszym okresie tuczu (30-60 kg) mieszankami bez (grupa I kontrolna) lub z dodatkiem różnego rodzaju tłuszczu: grupa II – techniczny tłuszcz zwierzęcy, III – bezerukowy olej rzepakowy, IV – tłuszcz o 15% lub V – 10% nienasyconych kwasów tłuszczowych (EUFA). W drugim okresie tuczu (60 -100 kg) wszystkie zwierzęta otrzymywały taką samą mieszankę, bez dodatku tłuszczu.

Na podstawie wyników poubojowych 5 tuczników z każdej grupy stwierdzono zwiększenie udziału kwasu linolowego w słoninie zwierząt otrzymujących dodatek tłuszczu o wysokiej zawartości EUFA, t.j. z grup III, IV, V. U wszystkich zwierząt z grup doświadczalnych zawartość kwasu linolowego była większa w wewnętrznej warstwie słoniny niż w warstwie zewnętrznej, u tuczników z grup III, IV i V zawartość kwasu oleinowego była mniejsza w wewnętrznej niż zewnętrznej warstwie słoniny.