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EFFECT OF THE FAT TYPE ALTERATION IN FEED DURING THE FINAL FATTENING PERIOD ON FATTY ACID COMPOSITION IN LOINS OF FATTENERS SLAUGHTERED AT DIFFERENT BODY WEIGHTS*

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The study was conducted on 32 crossbred fatteners (Polish Landrace × Large White Polish) × (Duroc x Pietrain). Fatteners belonging to group S were fed the compound feed with a 6% supplement of soybean oil during the fattening period (30-100 kg) while fatteners assigned to group L were fed the same feed until they reached 70 kg of body weight. At this point, the soybean oil supplement was changed to a 6% supplement of lard. To evaluate fatty acid profiles in loin, 4 fatteners from each group were slaughtered after achieving 70, 80, 90 and 100 kg of body weight. In the loin of fatteners fed over the entire fattening period with soybean oil in the feed mixture, the content of SFA at 100 kg of body weight was significantly lower ($p<0.05$) than at 70 kg of live weight and the content of PUFA at 90 kg ($p<0.05$) and 100 kg ($p<0.01$) was higher. However, no significant change was found in the MUFA content in loin during any part of the fattening period. In fatteners fed the mixture with a supplement of lard, a higher content of SFA at 100 kg of body weight ($p<0.05$) and lower content of PUFA ($p<0.05$) was found. The level of MUFA did not change during fattening. MUFA *n*-6:*n*-3 ratio in fatteners fed a diet with the share of soybean oil was significantly lower at 90 kg of live weight ($p<0.01$) than at 70 kg of body weight. No significant change was found in PUFA *n*-6:*n*-3 ratio in fatteners fed a diet with lard supplementation.

INTRODUCTION

The dietetic value of pig meat is determined mainly by the feeding of fatteners. In the opinion of many researchers, vegetable fat supplemented to the fatteners' diet results in a higher content of indispensable unsaturated fatty acids in pig meat as well as in a reduced cholesterol level [Grela, 2000; Barowicz *et al.*, 1998; Sawosz *et al.*, 2000]. However, the excessive content of unsaturated fatty acids in superficial and intramuscular fat, can worsen the sensory traits and shelf life of meat.

The disadvantageous results of fat supplementation in compound feed can be reduced if the vegetable fat supplement is discontinued or changed into fat with lower content of polyunsaturated fatty acids, during the final fattening period [Gill *et al.*, 1995].

There is relatively little evidence on how fast the composition of intramuscular fat changes in pigs of different breeds and genetic lines. The aim of the present study was studying this problem in relation to the crossbreeds used in Poland.

MATERIAL AND METHODS

The study was carried out on 32 crossbred fatteners (Polish Landrace × Large White Polish) × (Duroc × Pietrain) divided into two groups consisting of 8 gilts and 8 barrows each. Fatteners belonging to group S were fed *ad libitum* the complete mixture with a 6% soybean oil supplement, while fatteners belonging to group L from 70 kg of body weight were fed a mixture with a 6% pig lard supplement (Table 1, 2).

After the fatteners reached 70, 80, 90 and 100 kg of body weight, 4 fatteners (2 gilts + 2 barrows) of each group were slaughtered. Immediately after slaughter, samples of loin were collected (from 13 rib area).

The fatty acid profile was determined using a Varian 3400 CX gas chromatograph with DB 23 X column and argon as the carrier gas.

TABLE 1. Composition of diets (%).

Item	Diets	
	S (with soybean oil)	L (with Lard)
Ground barley	56.0	56.0
Ground wheat	20.0	20.0
Soybean meal	10.0	10.0
Meat and bone meal	6.0	6.0
Soybean oil	6.0	–
Lard	–	6.0
Lysine	0.5	0.5
Polfamix T	1.5	1.5
ME (MJ/kg)	13.7	13.6
Crude protein (g)	148.4	148.4

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TABLE 2. Fatty acid composition of dietary fat (%).

Item	Diets	
	S (with soybean oil)	L (with lard)
$C_{14:0}$	0.67	1.21
$C_{16:0}$	13.11	24.43
$C_{18:0}$	6.54	13.47
$C_{20:0}$	0.16	0.43
$C_{16:1}$	0.64	0.43
$C_{18:1}$	28.73	38.99
$C_{20:1}$	2.01	0.90
$C_{18:2}$	36.85	16.57
$C_{18:3}$	10.83	1.61
SFA	20.48	39.54
MUFA	31.38	41.49
PUFA	47.68	18.18

The results were analysed statistically using analysis of variance and the significance of differences between groups was evaluated with a Duncan test [Ruszczyc, 1978].

RESULTS

The participation of saturated fatty acids (SFA) in *longissimus dorsi* muscle of fatteners fed the compound feed with a 6% supplement of soybean oil over the whole fattening period (30–100 kg), systematically decreased from 38.05% at 70 kg of body weight to 35.21% at 100 kg of body weight ($p<0.05$). However, the alteration of soybean oil to lard in fatteners' diet from 70 kg of body weight caused a significant ($p<0.05$) increase of SFA content in muscle, which began from 90 kg of body weight, in comparison to fatteners fed the mixture with soybean oil (Table 3).

The participation of monounsaturated fatty acids (MUFA) in the loins of fatteners fed the feed mixture with a soybean oil supplement decreased along with an increase in body weight from 47.85% (70) kg to 44.81% (100 kg). However, the content of MUFA in fatteners fed with a lard supplement from 70 kg of body weight stayed at the same level throughout the entire fattening period (Table 3).

In fatteners fed over the whole fattening period, the compound feed with a 6% addition of soybean oil, a systematic rise in polyunsaturated fatty acids (PUFA) was noted. The addition of these acids at 90 kg of body weight was significantly ($p<0.05$) higher and at 100 kg highly significantly higher ($p<0.01$) than at 70 kg of body weight.

The change from soybean oil to lard caused a systematic decrease in PUFA content in loin. At 90 kg of body weight, the content of these acids was significantly ($p<0.05$) and at 100 kg, highly significantly ($p<0.01$) lower than in the loins of fatteners fed the mixture with a 6% addition of soybean oil over the whole fattening period.

The soybean oil addition to feed induced a PUFA *n*-6:*n*-3 ratio improvement, together with an increase in body weight. At 90 kg, it was highly statistically significantly ($p<0.01$) lower than at 70 kg of body weight. However, the proportions between these fatty acid families in the loin of the fatteners fed from 70 kg of body weight with a 6% supplement of lard in feed remained at almost the same level (Table 3).

TABLE 3. Fatty acid composition (%) of *longissimus* dorsi muscle at different slaughter weights.

Fatty acid	Group	Slaughter weight (kg)			
		70	80	90	100
$C_{14:0}$	S	0.70	0.78	0.85	0.83
	L	0.73	0.85	0.83	0.88
$C_{16:0}$	S	25.17	24.26	22.65	22.20
	L	25.18	25.17	25.98	26.36
$C_{18:0}$	S	12.08	12.60	12.91	12.05
	L	12.03	12.48	12.56	13.38
$C_{20:0}$	S	0.09	0.10	0.12	0.13
	L	0.08	0.11	0.10	0.14
$C_{16:1}$	S	2.66	2.55	2.53	2.67
	L	2.59	2.48	2.72	2.95
$C_{18:1}$	S	44.67	43.97	42.85	41.61
	L	44.27	44.63	44.47	45.96
$C_{20:1}$	S	0.52	0.51	0.46	0.53
	L	0.58	0.60	0.79	0.74
$C_{18:2}$	S	10.85	11.54	12.85	13.89
	L	10.76	10.37	10.00	9.39
$C_{18:3}$	S	0.78	0.92	1.46	1.51
	L	0.75	0.68	0.64	0.53
$C_{20:3}$	S	0.21	0.25	0.29	0.38
	L	0.29	0.29	0.25	0.21
$C_{20:4}$	S	1.70	1.87	2.07	1.61
	L	1.69	1.63	1.12	1.02
SFA	S	38.05^{a}	37.74	36.53^{x}	35.21^{ax}
	L	38.02^{a}	38.61	39.47^{x}	40.76^{ax}
MUFA	S	47.85	47.03	45.84	44.81
	L	47.44	46.64	47.98	47.65
PUFA	S	13.54^{Aa}	14.58	16.67^{ax}	17.39^{Axx}
	L	13.49^{a}	12.97	12.01^{x}	11.15^{axx}
n-6/*n*-3	S	16.35^{AB}	14.84	10.41^{Bxx}	10.51^{Axx}
	L	16.98	18.07	17.76^{xx}	18.00^{xx}

Values within a column differ significantly: x – $p<0.05$; xx – $p<0.01$. Values in the same rows with the same letters differ significantly: a – $p<0.05$; A,B – $p<0.01$.

To summarize, the change from soybean oil to lard in a diet during the second fattening period caused a statistically highly significant ($p<0.05$) rise in this index, already at 90 kg of body weight.

DISCUSSION

The change of a 6% supplement of vegetable fat (soybean oil) to a 6% addition of animal fat (lard) made in diet during the second fattening period (from 70 kg), caused a significant ($p<0.05$) increase in saturated fatty acids (SFA) in loin, after the fatteners reached 90 kg of body weight.

Together with the rise of SFA, the PUFA content decreased and after the fatteners achieved 90 kg it was significantly ($p<0.05$) lower than in the fatteners fed the mixture with a soybean oil supplement (Table 3).

The relations found between fatty acid composition in feed and animal tissues are confirmed by the research

carried out by Wiseman and Agunbiade [1998], where replacement of a 6% soybean oil supplement to a 6% lard supplement, made from 55 kg of body weight, induced a significant increase in SFA and a decrease in PUFA in backfat, after the fatteners reached 80 kg of body weight. Research by Wieseman and Agunbiade [1998] also confirmed that there is a possibility of fatty acid profile alteration in tissues through the change of fatty acid composition in feed during fattening. These authors changed a 6% lard supplement to a 6% soybean oil addition after the fatteners reached 55 kg of body weight. After they achieved 92.5 kg of body weight, a significant increase of unsaturated fatty acids and a decrease of saturated fatty acids was noted in the fatteners' tissues.

The change of the fat type in the present study did not induce significant changes in monounsaturated fatty acids in the loins during any of researched fattening periods. These results are also in agreement with the results obtained by Lenartowicz and Kulisiewicz [2000].

Lard participation in the second fattening period also did not cause significant changes in the PUFA *n*-6:PUFA *n*-3 ratio, which is in agreement with the results of research carried out by Kulisiewicz and Lenartowicz [1998] and Lenartowicz and Kulisiewicz [2000].

CONCLUSION

The change from a 6% soybean oil supplement to a 6% lard supplement in feed from 70 kg of body weight, induced significant ($p<0.05$) changes in the content of saturated and polyunsaturated fatty acids in the loins of fatteners slaughtered at 90 and 100 kg of body weight. Nevertheless, that alteration did not affect the MUFA content or change the PUFA *n*-6:PUFA *n*-3 ratio.

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WPŁYW ZMIANY RODZAJU TŁUSZCZU W DIECIE W KOŃCOWYM OKRESIE TUCZU NA SKŁAD KWASÓW TŁUSZCZOWYCH W POLĘDWICY TUCZNIKÓW UBIJANYCH PRZY RÓŻNEJ MASIE CIAŁA

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Badania przeprowadzono na 32 tucznikach mieszańcach ras (Polish Landrace × Large White Polish) × (Duroc × Pietrain). Tuczniki grupy S przez cały okres tuczu (30–100 kg) żywiono mieszanką z 6% dodatkiem oleju sojowego natomiast tucznikom grupy L od 70 kg masy ciała dodatek oleju sojowego zamieniono na 6% dodatek smalcu. Po osiągnięciu przez tuczniki masy 70, 80, 90 i 100 kg z każdej grupy poddano ubojowi po 4 szt. w celu oznaczenia profilu kwasów tłuszczowych w mięśniu polędwicy. W mięśniu polędwicy u tuczników żywionych przez cały okres tuczu paszą z udziałem oleju sojowego zanotowano istotnie ($p<0,05$) niższą zawartość SFA przy masie 100 kg niż przy masie 70 kg oraz wyższą zawartość PUFA przy masie 90 kg ($p<0,05$) i 100 kg ($p<0,01$). Nie stwierdzono istotnych zmian w żadnym okresie tuczu odnośnie zawartości MUFA w mięśniu polędwicy (tab. 3).

U tuczników żywionych mieszanką z dodatkiem smalcu stwierdzono wyższą zawartość SFA przy masie 100 kg ($p<0,05$) oraz niższą zawartość PUFA ($P<0,05$). Poziom MUFA nie uległ istotnym zmianom podczas tuczu (tab. 3).

Stosunek MUFA *n*-6:*n*-3 u tuczników żywionych dietą z dodatkiem oleju sojowego już przy masie 90 kg był istotnie niższy ($P<0,01$) niż przy masie 70 kg. U tuczników żywionych dietą z dodatkiem smalcu nie stwierdzono istotnych zmian w okresie tuczu w odniesieniu do proporcji PUFA *n*-6:*n*-3 (tab. 3).