

Restricted feeding and linseed oil as modifiers of the fatty acid profile in pork

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ABSTRACT

Thirty-two fatteners were divided into 4 groups: two of them were fed *semi ad libitum* (A) during the growing (22-60 kg) and finishing (60-102 kg) periods of fattening and two, a restricted (-25%) amount of feed (R) in the growing period and *semi ad libitum* in the finishing period. During the finishing period within each level of feeding, one group received 0 (AC and RC) and the other 4% (AO and RO) linseed oil. Pigs fed the restricted amount of feed had a more beneficial fatty acid profile in the *M. longissimus dorsi* and *M. semimembranosus*, however, the differences were not statistically significant. The 4% supplement of linseed oil in the finishing diets caused an increase in the PUFA content, of n-3 in particular.

KEY WORDS: fatteners, restricted feeding, linseed oil, carcass, fatty acid

INTRODUCTION

The main criteria for evaluating the functional properties of pork are its total fat and cholesterol contents and fatty acid profile. The SFA, MUFA and PUFA ratios are the most important (Wood et al., 2003). It is known that the fat content in pork increases most in the finishing period of fattening and that the composition of the feedstuff can influence the fatty acid profile of pork. The aim of the study was to evaluate the influence of restricted feeding during the growing period of fattening and linseed oil supplementation in finishing diets on the fatty acid profile of pork.

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MATERIAL AND METHODS

Thirty-two fatteners were divided into 4 groups: two of them were fed *semi ad libitum* (A) during the growing (22-60 kg) and finishing (60-102 kg) periods of fattening and two, restricted (-25%) amounts of feed (R) in the growing period and *semi ad libitum* in the finishing period. Within each level of feeding, during the finishing period one group received 0 (AC and RC) and the other 4% (AO and RO) linseed oil. The composition and nutritive value of the experimental diets are shown in Table 1.

TABLE 1

Composition (%) and nutritive value of feed mixtures in the growing and finishing periods

Item	Growing period	Finishing period	
		Group C	Group 0
Ground wheat	18.00	19.00	19.00
Ground barley	59.25	66.61	60.93
Wheat bran	3.00	-	-
Soyabean meal	17.20	11.80	13.20
Linseed oil	-	-	4.00
Vitamin E	-	-	0.30
Mineral-vitamin mix	2.20	2.25	2.25
L-lysine	0.27	0.24	0.22
DL-methionine	0.09	0.04	0.04
L-threonine	0.09	0.06	0.06
ME, MJ/1 kg	12.5	12.5	13.5
Crude protein, g/1 kg	153.4	134.3	146.6

After slaughter, samples of the *M. longissimus dorsi* (13-14 rib) and of the *M. semimembranosus* from the right half-carcasses of all of the animals were taken to determine the fatty acid profile (ISO 5509, 1978 and ISO 5508, 1990). The results were subjected to one-way analysis of variance employing Duncan's multiple range test (SPSS, 2000).

RESULTS

The lipid fraction of the *M. longissimus dorsi* from fatteners from groups AO and RO contained, in comparison with AC and RC, a larger amount of SFA (differences were not significant) and PUFA n-3 ($P \leq 0.001$), but in the lipid fraction of the *M. semimembranosus*, these differences concerned both PUFA n-6 and PUFA n-3 were significant ($P \leq 0.001$). Supplementation of the diets with linseed oil narrowed the PUFA n-6:PUFA n-3 ratio. A more beneficial fatty acid profile, PUFA n-6:PUFA n-3, and PUFA:SFA ratios were found in fatteners fed restricted amounts of feed in the growing period of fattening in comparison with fatteners fed *semi ad libitum* during the whole fattening period.

TABLE 2

Fatty acid profile, % of sum of fatty acids

Group Item	Fatty acid										
	14:0	16:0	16:1	18:0	18:1	18:2	18:3	20:4	20:5	22:4	22:6
<i>M. longissimus dorsi</i>											
AC	1.32	25.57	4.17	12.86	46.77	6.58	0.40	1.58	0.16	0.33	0.28
AO	1.38	25.57	3.90	13.08	45.14	6.78	2.22	0.90	0.39	0.19	0.46
RC	1.29	25.26	4.27	12.03	46.08	7.71	0.47	1.93	0.19	0.40	0.38
RO	1.30	24.75	3.70	13.14	44.58	7.79	2.31	1.20	0.48	0.20	0.57
Se	0.020	0.117	0.076	0.131	0.378	0.324	0.062	0.100	0.025	0.022	0.029
p	NS	NS	NS	0.021	NS	NS	0.001	0.006	0.001	0.005	0.012
<i>M. semimembranosus</i>											
AC	1.33	24.29	4.01	12.53	49.72	6.14	0.49	0.96	0.12	0.23	0.18
AO	1.29	23.90	3.68	12.49	45.26	8.29	3.15	0.95	0.38	0.18	0.45
RC	1.29	24.22	4.24	11.46	47.15	8.26	0.58	1.93	0.17	0.37	0.34
RO	1.26	23.50	3.38	12.55	43.41	10.22	3.39	1.16	0.43	0.20	0.51
Se	0.013	0.088	0.062	0.130	0.389	0.250	0.071	0.093	0.025	0.020	0.025
p	NS	0.013	0.001	0.013	0.001	0.001	0.001	0.002	0.001	0.009	0.001
	SFA	MUFA		PUFA n-6		PUFA n-3		PUFA n-6/n-3		PUFA/SFA	
<i>M. longissimus dorsi</i>											
AC	39.75	50.93		8.49		0.83		10.38		0.24	
AO	40.03	49.04		7.87		3.06		2.56		0.28	
RC	38.58	50.35		10.04		1.03		9.83		0.29	
RO	39.19	48.27		9.18		3.36		2.73		0.32	
Se	0.208	0.426		0.433		0.112		0.137		0.014	
p	NS	NS		NS		0.001		0.001		NS	
<i>M. semimembranosus</i>											
AC	38.15	53.73		7.32		0.79		9.48		0.21	
AO	37.68	48.94		9.41		3.98		2.36		0.36	
RC	36.97	51.39		10.56		1.08		9.85		0.32	
RO	37.30	46.79		11.58		4.34		2.68		0.43	
Se	0.183	0.395		0.332		0.091		0.158		0.011	
p	NS	0.001		0.001		0.001		0.001		0.001	

DISCUSSION

Numerous experiments have demonstrated that there is a close correlation between the quantity of fatty acids in feed and in the lipid fraction of pork (Nguyen et al., 2003). Increasing PUFA n-3 in a diet by adding fish oil or vegetable oil, particularly linseed oil, can beneficially affect the lipid composition of pork (Muriel et al., 2002; Raes et al., 2004); the PUFA n-6/n-3 ratio can even be decreased to under the value of 3 (Enser et

al., 2000). Compensatory growth can change fat deposition in the finishing period, and when oil containing more PUFA is fed during this period, the fatty acid profile can be improved.

CONCLUSIONS

Linseed oil-supplemented diets beneficially influenced the fatty acid profile in pork fat. Restricted feeding itself does not markedly influence the fatty acid profile, but when linseed oil is fed in the finishing period of fattening, an increase in PUFA incorporated into the fat from the diet was observed.

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STRESZCZENIE

Ograniczone żywienie i olej lniany jako czynniki modyfikujące profil kwasów tłuszczowych wieprzowiny

W doświadczeniu przeprowadzonym na 32 tucznikach badano profil kwasów tłuszczowych w tłuszczu mięśniowym jako funkcję żywienia ograniczonego i dodatku oleju lnianego do dawki. Dwie grupy tuczników żywiono *semi ad libitum* (A) w całym okresie tuczu (22-102 kg), dwóm podawano ograniczoną ilość paszy (-25%) w pierwszym okresie (22-60 kg) tuczu (R), a *semi ad libitum* w drugim okresie. W każdej z par grup w drugim okresie tuczu jedna otrzymywała dodatek 4% oleju lnianego (O), a druga 0% (C). Po uboju w mięśniach *longissimus dorsi* i *semimembranosus* oznaczano profil kwasów tłuszczowych. Stosunek PUFA n-6 : n-3 był nieco lepszy w tłuszczu mięśniowym świní żywionych ograniczoną ilością paszy niż żywionych *semi ad libitum*, ale różnice nie były statystycznie istotne. Dodatek 4% oleju lnianego do paszy w drugim okresie tuczu spowodował zwiększenie zawartości PUFA, zwłaszcza n-3.