

## INVESTIGATIONS ON THE EFFECT OF SWINE GENOTYPE ON THE LEVEL OF FATTY ACIDS IN PORK MEAT

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### Introduction

The role of fat in nutrition, especially the type of fatty acids occurring in it, is very important for human health. Many studies were devoted to investigations on the effect of feeding animals feeds supplemented with seeds of oil plants rich in linolenic acid C18:2 (Wood et al., 1999) or vitamin E (Ishida et al., 1999) with the aim to reduce the proportion of omega 6 acids to omega 3 acids in animal fat. The objective of this research project was to determine the influence of different swine genotypes on the level of fatty acids in meat tissue lipids.

### Methods

The performed studies were conducted on 5 groups of fatteners, 30 animals in each, differing in the type of genotype. The control group (C) comprised pure breed fatteners (PLW x PLW). The parental material for three experimental groups derived from sows obtained from crossings of sows of Polish Large White (PLW) with Polish Landrace (PL) boars. Sows were mated with boars of the following breeds: group D - (PLW x PL) x Duroc, group HD - (PLW x PL) x Hampshire x Duroc, group H - (PLW x PL) x Hampshire. Another experimental group comprised fatteners from a synthetic PIC line. All the experimental animals came from the same farm and were fed identical complete diets. The content of intramuscular fat (IMF) in tissue of the *musculus longissimus dorsi* (LD) was determined by Soxhlet method. The analysis of fatty acids profiles were done by gas chromatography of respective methyl esters on capillary column coated with the Rtx-2330 (105 m x 0.25 mm x 20 µm) using Hewlett Packard GC model 6890 with a flame-ionization detector. The obtained results were processed statistically using the analysis of variance. The significance of differences between groups was determined using Tukey test (Stanisz, 1998).

### Results and discussion

The significance of the effect of genotype on the content of intramuscular fat (IMF) was confirmed statistically. The lowest fat content was found in the LD of fatteners of the PIC synthetic line, while the highest - in hybrids from group D which is characteristic for fatteners with a 50% blood upgrade of Duroc breed (Wood et al., 1994).

In comparison with the control group, genetic groups with Hampshire boars were characterised by a more favourable profile of IMF fatty acids. In the pool of fatty acids of these fatteners, the authors found a statistically significantly lower proportion of saturated fatty acids (SFA) and higher - of unsaturated fatty acids (UFA). The content of UFA in group HD was by 4.74% and in group H - by 4.5% higher than in the control group.

The highest concentration of mono-unsaturated fatty acids (MUFA) was found in hybrids from group D and the lowest - in fatteners from PIC line (respectively: 53.32% and 45.55%).

The lowest content of poly-unsaturated fatty acids (PUFA) was observed in fatteners from group D - 6.91%, while in the remaining groups their content was higher, namely: in group H - by 8.2%, in PIC - by 7.7%, in HD - by 5.1% and C - by 2.9%. In addition, the proportion of PUFA to MUFA was more favorable in these groups. Poly-unsaturated acids from n-3 family have been gaining increasingly growing interest of both doctors and nutritionalists. Their main representatives are: linolenic acid L C18:3 and its derivatives: eicosapentaenoic acid EPA - C20:5 and docosahexaenoic acid - C22:6 (Okuyama 1999). From among the examined genetic groups of swine, the highest content of PUFA - omega 3 was found in IMF of the PIC synthetic line, while the lowest - in fatteners with 50% share of Duroc breed boars. This can probably be attributed to the higher content of intramuscular fat in the meat tissue of group D. Moreover, from the point of view of nutrition, the ratio of PUFA omega 6 to omega 3 is more favorable in PIC hybrids (4.98) in comparison with the remaining groups (C - 6.52; HD - 8.24; H - 9.54 and D - 10.91). In general the ratio of these acids in pigs ranges from 8 - 10, as confirmed by other authors (Ishida et al., 1999; Wood et al., 1999).

IMF of hybrids from the control group and PIC line, in comparison with that of the remaining groups, contained significantly more (by about 2-3%) acids showing OFA hypercholesterolemic activity and fewer acids (by 2-3%) exhibiting DFA neutral or hypocholesterolemic activity.

### Conclusions

From among the examined genetic groups of swine, the highest IMF content was recorded in the muscle tissue of fatteners with 50% blood upgrade of Duroc breed. Moreover, the highest number of SFA and the lowest of UFA characterized muscle tissue of this group. More poly-unsaturated fatty acids were found in groups crossed with Hampshire and in the PIC line. Furthermore, PIC fatteners were characterized by a more favorable ratio of PUFA omega 6 to omega 3.

The comparison of these data allows to conclude that not only feeding has effect on level of intramuscular fat and omega 6 to omega 3 acids ratio but also the genotype of pigs.

### References

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**Table 1.** Lipid content (IMF) and fatty acid composition (% of total acids) in longissimus dorsi muscle of pigs

Item	Groups				
	K	D	HD	H	PIC
IMF content (%)	3,36A	4,79B	3,25A	3,45A	2,16C
Total SFA	41,94A	38,34C	36,56B	36,32B	39,67C
Total UFA	58,19A	60,23B	62,93C	62,78C	60,21B
Total MUFA	48,41A	53,32B	50,92C	47,70AD	45,55D
Total PUFA	9,78A	6,91B	12,01C	15,08D	14,66D
PUFA/MUFA	0,20A	0,13B	0,23A	0,32C	0,32C
omega-3 PUFA	1,30A	0,58B	1,30A	1,43A	2,45C
omega-6 PUFA	8,48A	6,33B	10,71C	13,65D	12,21CD
PUFA omega-6 / omega-3	6,52A	10,91B	8,24B	9,54B	4,98C
OFA	26,30A	23,96B	24,12B	23,73B	25,54A
DFA	72,78A	74,17B	74,69B	74,88B	73,24A

IMF intramuscular fat

SFA total saturated fatty acids

UFA total unsaturated fatty acids

MUFA monounsaturated fatty acids

PUFA polyunsaturated fatty acids

OFA dietary fatty acids having undesirable (hypercholesterolemnic) effect in human (C14 + C16)

DFA dietary fatty acids having desirable neutral or hypocholesterolemnic effect in human (UFA + C18:0)

A,B,C – significant at  $P \leq 0,01$

**Table 2.** Level of individual fatty acids (% of total acids) in lipid of longissimus dorsi muscle of pigs

Fatty acids	Groups				
	K	D	HD	H	PIC
Myristic, C14:0	1,49A	1,22B	1,19B	1,12B	1,48A
Palmitic acid, C16:0	24,81A	22,74B	22,93B	22,61B	24,06A
Stearic acid, C18:0	14,59A	13,94AC	11,76B	12,10CB	13,03C
Oleic acid, C18:1	44,19A	48,44B	46,55A	43,57CA	41,37C
Linoleic acid, C18:2	6,85A	5,62B	8,58B	10,79C	10,05C
Linolenic acid, C18:3	0,73A	0,58B	0,74A	0,71A	0,68A
Arachidonic acid, C20:4	1,09A	0,71B	1,47A	2,11C	1,47A
EPA, C20:5	0,19A		0,15A	0,19A	0,62B
DHA, C22:6	0,11A		0,11A	0,12A	0,56B

EPA – eicosapentaenonic acid

DHA – docosahexaenonic acid

A,B,C – significant at  $P \leq 0,01$