

Influence of breed and body weight of pigs on the fatty acid profile of *Musculus longissimus dorsi*

**St. Raj¹, G. Skiba¹, D. Weremko¹, H. Fandrejewski¹, W. Migdał²
and F. Borowiec³**

¹*The Kielanowski Institute of Animal Physiology and Nutrition, Polish Academy of Sciences
05-110 Jabłonna, Poland*

Agricultural University of Cracow,

²*Department of Pigs Breeding,*

³*Department of Animal Nutrition*

Al. Mickiewicza 24/28, 30-059 Kraków, Poland

ABSTRACT

Eighty gilts representing sire breeds: Belgian Landrace (B), Duroc (D), Hampshire (H), Pietrain (P) and synthetic line 990 (S), were slaughtered successively at 70, 90, 110 and 130 kg BW and their profile of fatty acids in *Musculus longissimus dorsi* was determined. The proportions of monounsaturated fatty acids (MUFA) increased, while polyunsaturated (PUFA) and the PUFA-to-saturated fatty acids (SFA) ratio decreased with the increasing body weight of pigs. The proportion of MUFA was higher and that of PUFA was lower in D and S pigs than in other breeds. The PUFA n-6:n-3 ratio was not affected by the breed and weight of pigs.

KEY WORDS: pigs, breeds, slaughter weight, fatty acids

INTRODUCTION

The nutritive value of pork depends, among others, on the fat content in the carcass and fatty-acid profile, especially of those having hypocholesterolaemic effects. The fatty acid content in animal fat tissues is directly influenced by the dietary fat composition (Bee et al., 2004) but also depends on the genetic potential of the animals (Nürnberg et al., 1998; Edwards et al., 2003). Due to breeding for a high meat content and reduced amount of adipose tissue in the carcass, the proportion of polyunsaturated fatty acids in lean pigs is high. However, in recent literature there is

¹ Corresponding author: e-mail: s.raj@ifzz.pan.pl

no data on changes in the fat content and fatty-acid profile of *Musculus longissimus dorsi* (*mld*) occurring during growth of pigs of different sire breeds. The aim of the study was to investigate the changes in the *mld* fatty-acid profile in gilts of sire breeds during the growth period from 70 to 130 kg BW.

MATERIAL AND METHODS

The study was carried out on 80 gilts growing from 70 to 130 kg BW, representing sire breeds bred in Poland: Duroc (D), Hampshire (H), Pietrain (P), Belgian Landrace (B) and synthetic line 990 (S). The animals were kept individually and fed *ad libitum* a diet containing in kg 13.2 MJ ME and 8.9 g digestible lysine, supplemented with 2% of rapeseed oil. The fatty acid profile (%) of the ether extract of the diet was: C14:0, 0.24; C16:0, 15.71; C16:1, 0.45; C18:0, 3.93; C18:1, 28.37; C18:2, 46.37; C18:3, 3.30; C20:0, 0.32; C20:1, 0.63; C20:2, 0.35; C20:3, 0.08; other, 0.25.

The pigs were slaughtered at 70, 90, 110 and 130 kg BW, samples of *mld* were taken from the part behind the last rib, and analysed for chemical composition and fatty acids using a VARIAN 3400 CX gas chromatograph with a DB - 23X column and argon as the carrier gas. Statistical analysis was performed by Statistica 2001 software using two-way analysis of variance ANOVA and Tukey's multiple range test.

RESULTS

Along with the increase of body mass, the proportion of monounsaturated fatty acids (MUFA) in the sum of all acids in *mld* rose, while the proportion of polyunsaturated (PUFA) and PUFA-to-SFA ratio, decreased (Table 1). Belgian

Table 1. Fatty acid profile of *Musculus longissimus dorsi* in pigs of different body weight (BW) and breed, % of sum

Treatment	Sum of fatty acids				
	SFA	MUFA	PUFA	PUFA:SFA	PUFA n-6:n-3
BW, kg					
70	35.3	38.7 ^A	24.6 ^A	0.70 ^A	11.88
90	35.8	39.6 ^B	23.0 ^A	0.64 ^B	12.42
110	35.9	39.5 ^B	22.4 ^A	0.62 ^B	11.52
130	35.9	42.2 ^C	19.8 ^B	0.55 ^C	11.53
Breed					
B	35.0	38.2 ^A	24.2 ^A	0.70 ^A	12.47
D	35.7	41.7 ^B	20.4 ^B	0.58 ^B	11.88
H	35.9	39.7 ^C	22.7 ^C	0.64 ^C	11.37
P	34.9	37.4 ^A	25.8 ^A	0.74 ^A	11.99
S	36.0	42.9 ^B	20.3 ^B	0.58 ^B	11.49
SEM	0.47	0.52	0.68	0.028	0.313
Interaction	0.08	0.39	0.11	0.136	0.073

¹ B - Belgian Landrace, D - Duroc, H - Hampshire, P - Pietrain, S - synthetic line 990

Landrace and Pietrain pigs were leaner (data not shown) and had a lower MUFA and higher PUFA proportion than pigs of Duroc, Hampshire and line 990 breeds. The proportion of SFA in the *mld* fat of Duroc and line 990 was insignificantly higher, that of MUFA, significantly higher than in the other breeds, while their PUFA and PUFA:SFA ratios were lower.

DISCUSSION

The fat content of the carcass systematically increased with increasing body weight and was strongly affected by the pig's genotype. Different rates of fat deposition influenced the fat content in the loin, which was smaller in leaner Belgian Landrace and Pietrain pigs than in Duroc and line 990. The effects of breed on the fat content in *mld* are equivocal as some researchers detected differences in intramuscular fat content between Pietrain and Landrace pigs (Hausner et al., 1997), but others did not find such differences (Schöne et al., 2002).

With increasing weight, the total MUFA content in *mld* fat in pigs increased while the PUFA and PUFA:SFA ratio decreased. Literature data show that saturated fatty acids are the main product of fat metabolism and their relative percentage in adipose tissue increases until about 180 days of age and thereafter the fatty-acid profile usually does not change (Nürnberg et al., 1988). In our study the interaction of body weight and breed was not significant but a tendency towards a more pronounced effect of body weight on decreasing the PUFA proportion and PUFA:SFA ratio was found in Duroc and line 990, and a smaller tendency, in Belgian Landrace and Pietrain. This may result from a greater response of lean pigs to dietary PUFA since in those pigs *de novo* synthesis of SFA is less pronounced, whereas in fatter pigs it is more intensive, leading to differences in the PUFA content in deposited fat between these two types of pigs (Cameron et al., 1999).

The pigs in our study had a generally greater concentration of PUFA and MUFA in the intramuscular *mld* fat than reported values, probably resulting from the 2% rapeseed oil supplement. According to Schöne et al. (2002) such supplementation increases the content of oleic and alfa-linolenic acid in backfat and intramuscular fat.

Neither breed nor body weight had any effect on the PUFA n-6:n-3 ratio.

CONCLUSIONS

The different proportions of MUFA and PUFA, and the PUFA:SFA ratio in *Musculus longissimus dorsi* fatty acids in pigs of several breeds point to the

effects of genotype on the quality of intramuscular fat. This effect seems to be related to the rate of fat deposition.

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STRESZCZENIE

Wpływ rasy i masy ciała świń na profil kwasów tłuszczowych w *Musculus longissimus dorsi*

Osiemdziesiąt loszek rasy: belgijskiej zwislouchej (B), duroc (D), hampshire (H), pietrain (P) oraz linii 990 (S) ubito przy masie ciała 70, 90, 110 i 130 kg i w mięśniu *longissimus dorsi* (*mld*) oznaczono profil kwasów tłuszczowych. Stwierdzono, że wraz ze wzrostem masy ciała zwiększała się zawartość MUFA, natomiast zmniejszała się zawartość PUFA oraz proporcja PUFA:SFA. W *mld* świń rasy D i S było więcej ($P<0,01$) MUFA i SFA, a mniej ($P<0,01$) PUFA i mniejsza ($P<0,01$) była proporcja PUFA:SFA niż u świń ras B, H i P. Nie wykazano wpływu masy ciała i rasy świń na proporcje długołańcuchowych kwasów PUFA n-6:n-3 w *mld*.