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THE SHARE OF TISSUES IN THE PIG ROUND DEPENDING ON THE GENOTYPE, GENDER AND SEASON

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Abstract: The study included 201 offspring (108 castrated males and 93 females) of Landrace (L), Large White (LW) and Pietrain (P) sires. The studied animals were of following genotype: Landrace (L; n = 48); two breed crosses with 50:50 share of parental breeds (LWxL, n=32; and PxL, n=23), two breed crosses with 75% of paternal breed [Lx(♀LWxL), n=35] and [LWx(♀LxWL) n=38] and three breed crosses [Px(♀LWxL) n=25]. Animals included in this study were born during four seasons: winter (n=38), spring (n=65), summer (n=40) and autumn (n=58). Studies have shown that, at an average weight of warm carcass side of 81.20 kg, the highest average values for the weight of round (RW; 10.204 kg), the weight of intermuscular fatty tissue (RINT; 0.478 kg), bone tissue (RBT; 0.850 kg) and muscle tissue (RMT, 7.552 kg) in the round, were established in three-breed crosses of Px (LWxL) genotype compared to other genotypes. The least skin and subcutaneous fatty tissue (RST; 1.269 kg) was recorded in two breed crosses PxL. They had less skin and subcutaneous fatty tissue by 454 g and 467 grams, respectively, compared to two breed crosses (LWxL) and LWx (♀LxLW). Research has shown that there is a genotype on a farm that gives more muscle tissue in the round by 1.521 kg [Px (♀LWxL): LWx (♀LWxL)] with the same weight of warm carcass side, which is a very large difference. With the same average weight of warm carcass side, female animals had higher average weight of the round and yield of muscle tissue compared to male castrated animals. The effect of genotype ($P<0.001$) on all investigated traits was recorded, also the effect of the season of birth on the skin and subcutaneous fat tissue and on the weight of intermuscular fat in the round was recorded. The effect of sex/gender was significant ($P<0.01$) on the weight of skin and subcutaneous fat and on the weight

of the muscle tissues in the round but no significant effect on other tested properties (P> 0.05) was observed.

Key words: fatteners, fatty tissue, bone tissue, muscle tissue of the round

Introduction

Pigs have the highest level of accumulation of fat tissue in the carcass, of all the species of domestic animals. In the case of new-born piglets, the content of fat tissue in the carcass is only about 2% and its share in the carcass increases with the age of the animal. During lifetime of pigs, until the end of the fattening period, mainly the subcutaneous fat tissue is accumulated, which on average accounts for 60 to 70% of the total fat tissue in the body; the fat tissue of the body cavities makes up 10 to 15%, and intermuscular fat 20 to 35%. The content of intramuscular fat tissue in most industrial pig genotypes is between 2.5 and 3.5% *(Karolyi, 2007). Dević and Stamenković (2004)* have concluded that the selection/breeding can influence the content of the intramuscular fatty tissue, i.e. the content of fat in the meat.

In the studies of *Mason et al. (2005)* statistically significant differences (P<0.001) have been found for intramuscular fat content in ML (2.31:3.32%) between offspring of the Landrace and Duroc sires. As for the effect of sex on the amount of fat in the pig carcass, *Čepin and Žgur (2003)* state that uncastrated male animals, compared to females, have significantly lower percentage of fat, with the same dietary regime. They also state that the selection/breeding is a powerful instrument for reduction of fat content, and that adequate animal nutrition provides the ability to reduce fat content and fatty acid changes. Observing the share of certain tissues in the four basic parts of the carcass side (round, back, shoulder and ribs) in gilts and castrated males, *Kušec et al. (2006)* have found that the highest share of the muscle tissue is in the round, and that the highest share of fatty tissue is in the rib section, while the highest share of bone tissue is found in the back. By comparing the shares of the most important tissues of the main carcass parts with respect to the total quantity of individual tissues in the examined pigs, statistically significant differences were found between the sexes/genders only in the share of the round bone tissue in the total amount of bones *(Kušec et al., 2006)*. Distribution of fatty tissue, as well as the total amount of fat in the carcass, varies considerably between pigs of different breeds. For example, there is a clear difference in the content of intramuscular fat between various pig genotypes. It is generally higher in Duroc pigs than in Landrace or Large white pigs, although differences in the content of the subcutaneous and abdominal fat tissue between pigs of different genotypes can be small. Distribution of fatty tissue in the pig carcass can be changed relatively easily through selection/breeding. Variations in energy intake are the decisive

factor in the distribution of fatty tissue, as well as the total amount of fat in the pig carcass of certain genotype *(de Lange et al., 2003)*. In animals intended for meat production, the estimated heritability for the fat content is relatively high (between 0.3 and 0.6). This means that the selection/breeding is a powerful instrument for reducing fat content. An even better option for reducing fat content and changing fatty acid profile is adequate nutrition, especially in non-ruminant animals, since these animals absorb fatty acids in unchanged form *(Čepin and Žgur, 2003).* A complete statistically significant phenotypic correlation (r_P=0.975 **) between the share of muscle tissue in the round and the estimated lean meat content through dissection was reported in the research by *Senčić et al. (1991).*

Material and Methods

The study included 201 offspring (108 castrated males and 93 females) originating from sires of following breeds: Landrace (L), Large White (LW) and Pietrain (P). The studied animals were following genotype: Landrace (L; n = 48) genotype; two breed crosses with 50:50 share of parental breeds (LWxL, n=32; and PxL, n=23), two breed crosses with 75% of paternal breed [Lx(♀LWxL), n=35] and [LWx(♀LxWL) n=38] and three breed crosses [Px(♀LWxL) n=25]. Animals included in this study were born in four seasons: winter (n=38), spring (n=65), summer (n=40) and autumn (n=58). The separation of the round from the back (loin-lumbar) part and of the belly part was performed by a right angle cut in relation to the longitudinal axis between the last and the second to last, i.e. between the 5th and 6th lumbar vertebrae *(Walstra and Merkus, 1996).* After separating the round, total dissection was performed separating the skin and subcutaneous fat tissue, intermuscular fat, muscle tissue and bone tissue.

Figure 1. Separation and dissection of the round (Photo: Č. Radović)

The research was carried out on the farm, experimental slaughterhouse and in the laboratory of the Institute for Animal Husbandry, Zemun-Belgrade. Data was processed by applying the appropriate software package "LSMLMW and MIXMDL, PC-2 VERSION" *(Harvey, 1990)*, i.e. by using the procedure of the Least Squares Method in order to determine the significance ($P<0.05$) of systematic influences on the traits of meat quality. The model included: genotype, gender, birth season of offspring and carcass side weight (linear effect).

$$Y_{ijkl} = \mu + G_i + P_j + S_k + b_1(x_1 - \bar{x}_1) + \varepsilon_{ijkl}$$

Results and Discussion

Table 1 shows the LSMean values of the properties of the round. Animals of the genotype n. 6 [Px (LWxSL)], with the same weight of warm carcass side, showed higher values for RW and RMT compared to other genotypes. Fatteners of genotype 9 (75% LW) had the lowest mean values for weight of the round (8.931 kg) and muscle tissue (6.031 kg). Also animals born in the winter period had the lowest value for RW (9.220 kg), but these animals had the highest value for RMT (6.868 kg) compared to animals born in other periods. A very significant ($P<0.001$) effect of the weight of warm carcass sides on the weight and yield of individual tissues of the round was established by total dissection. The total weight of the round increased by 118 g/kg of the warm carcass side weight while the meat yield increased by 79 g per kilogram of warm carcass side. The genotype showed effect on ($P<0.001$) all investigated properties (Table 1). the season of birth on the weight of skin and subcutaneous fat tissue and on the weight of intermuscular fat of the round. The sex/gender significantly affected ($P <0.01$) the weight of skin and subcutaneous fat and the mass of the muscle tissue of the round but no significant effect was observed on other studied properties ($P>0.05$).

Table 1. The effect of genotype, sex/gender and season on the quality properties of the round in the offspring (LSMean ± S.E.)

Source of variation		RW[4)], kg	RST, kg	RINT, kg	RBT, kg	RMT, kg
μ ± S.E.		9.264±0.06	1.462±0.04	0.401±0.02	0.762±0.01	6.639±0.08
Genotype	1[1)]	9.003±0.06	1.297±0.04	0.344±0.02	0.766±0.01	6.596±0.08
	2	9.112±0.10	1.723±0.07	0.401±0.03	0.741±0.02	6.247±0.12
	5	9.290±0.14	1.269±0.10	0.334±0.04	0.767±0.02	6.920±0.18
	6	10.204±0.10	1.324±0.07	0.478±0.03	0.850±0.02	7.552±0.13
	8	9.046±0.18	1.424±0.13	0.411±0.05	0.722±0.03	6.490±0.23
	9	8.931±0.21	1.736±0.15	0.439±0.06	0.725±0.03	6.031±0.28
P[2)]		***	***	***	***	***
Sex	M[3)]	9.181±0.08	1.579±0.06	0.413±0.02	0.747±0.01	6.442±0.11
	F	9.347±0.08	1.345±0.06	0.390±0.02	0.776±0.01	6.836±0.11
P		NS	**	NS	NS	**
Season	Winter	9.220±0.17	1.219±0.12	0.376±0.04	0.756±0.03	6.868±0.22
	Spring	9.251±0.08	1.646±0.06	0.484±0.02	0.739±0.01	6.382±0.10
	Summer	9.294±0.09	1.574±0.06	0.383±0.02	0.775±0.01	6.563±0.11
	Autumn	9.292±0.07	1.408±0.05	0.363±0.02	0.777±0.01	6.745±0.10
P		NS	***	***	*	*
WCS (b)		0.118***	0.027***	0.006***	0.006***	0.079***

[1)]1-SL. 2-LWxSL. 5-PxSL. 6-Px(LWxSL). 8-SLx(LWxSL). 9-LWx(LWxSL); [2)]NS=P>0.05;*=P<0.05;**=P<0.01; ***=P<0.001; [3)]M- castrated males. F-females.WCS(b)- linear effect of the weight of warm carcass side; [4)] RW-weight of the round. RST- weight of the skin and subcutaneous fat tissue of the round.RINT- weight of the intermuscular fat tissue of the round.RBT- weight of the bone tissue of the round. RMT- weight of the muscle tissue of the round

With the average weight of the warm carcass side of 81.20 kg the highest average values for the weight of the round (RW; 10.204 kg) weight of the intermuscular fat tissue (RINT; 0.478 kg) bone tissue of the round (RBT; 0.850 kg) and muscle tissue of the round (RMT; 7.552 kg) were established in three-breed crosses of Px (LWxL) genotype compared to other genotypes. *Pulkrábek et al. (2006)* show in their study that the crosses had the share of muscles in the round of 84.93% (class R) up to 88.12% of the total weight of the round (class S) which is a significantly higher share than value of 71.66% obtained in the present study by observing the share of muscle tissue in the total weight of the round for all examined animals. A higher share of muscle tissue of the round in the total weight of the round was determined in the research by *Kosovac et al. (2008)* in relation to our research. In this research the share of muscular tissue of the round for following genotypes: the Swedish Landrace (SL) - 73.12%, for the three-breed combination with Duroc [Dx (SLxLW)] - 77.25% and for the three breed combination with Pietrain [Px (SLxLW)] – 76.46%. The influence of sex/gender on the total weight of the round was established by *Bahelka et al. (2007)*, which is contrary to our research. In the

mentioned study, and in concordance with the present research, greater weight of the round was recorded in the female animals than in castrated males. *Kušec et al., (2006)* have found that female animals have a higher share of total fat tissue and a higher share of subcutaneous fat tissue compared to not castrated males. The fact that muscular and fatty tissue depend on sex/gender is in concordance with our research (*Renaudeau et al., 2005; 2006; Renaudeau and Mourot, 2007; Serrano et al., 2007; Radović et al., 2008).*

Conclusion

With the average weight of the warm carcass side of 81.20 kg, the highest average values for the weight of the round (RW; 10.204 kg), weight of the intermuscular fat tissue (RINT; 0.478 kg), bone tissue of the round (RBT; 0.850 kg) and muscle tissue of the round (RMT; 7.552 kg) were established in three-breed crosses of Px (LWxL) genotype compared to other genotypes. The least skin and subcutaneous fatty tissue (RST. 1.269 kg) was recorded for PxL two-breed crosses. They had less skin and subcutaneous fatty tissue by 454 g and 467 grams, respectively, in relation to two breed crosses (LWxL) and LWx (♀LxLW). The research has shown that we have a genotype on a farm that gives more muscle tissue in the round by 1.521 kg [Px (♀LWxL): LWx (♀LWxL)] with the same weight of warm carcass side, which is a very large difference. With the same average weight of warm carcass side, female animals had a higher average weight of the round and a higher yield of muscle tissue compared to male castrated animals. The genotype showed effect on ($P<0.001$) all investigated properties (Table 1), the season of birth on the weight of skin and subcutaneous fat tissue and on the weight of intermuscular fat of the round. The sex/gender significantly affected ($P<0.01$) the weight of skin and subcutaneous fat and the mass of the muscle tissue of the round but no significant effect was observed on other studied properties ($P>0.05$). Based on the results presented, it is obvious that breeders should have terminal breeds in their herds, primarily Pietrain, in the production of fresh meat, as they have a significantly higher share of muscle tissue in the round, and therefore greater lean meat content, i.e. meatiness of the carcass sides.

Udeo tkiva u svinjskom butu u zavisnosti od genotipa, pola i godišnjeg doba

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Rezime

Istraživanje je obuhvatilo 201 potomka (108 kastriranih mužjaka i 93 ženke) očeva nerastova rase landras (L), jorkšir (LW) i pijetren (P). Ispitane životinje su bile sledećeg genotipa: landras (L; n = 48); dvorasni melezi sa 50:50 učešća roditeljskih rasa (LWxL, n=32; i PxL, n = 23), dvorasni melezi sa 75% roditeljske rase [Lx(♀LWxL), n=35] i [LWx(♀LxWL) n=38] i trorasni melezi [Px(♀LWxL) n=25]. Životinje uključene u ovo istraživanje rođene su tokom četiri godišnja doba: zima (n=38), proleće (n=65), leto (n=40) i jesen (n=58). Istraživanja su pokazala da su pri prosečnoj težini tople polutke od 81,20 kg, najveće prosečne vrednosti za masu buta (RW; 10,204 kg), masu međumišičnog masnog tkiva (RINT; 0,478 kg), koštanog tkiva (RBT; 0,850 kg) i mišićnog tkiva (RMT, 7,552 kg) u butu, utvrđeni kod trostranih meleza Px(LWxL) genotipa u poređenju s drugim genotipima. Najmanje kože i potkožnog masnog tkiva (RST; 1,269 kg) zabeleženo je kod dvorasnih meleza PxL. Imali su manje kože i potkožnog masnog tkiva za 454 g, odnosno 467 grama, u poređenju sa dvorasnim melezima (LWxL) i LWx (♀LxLW). Istraživanja su pokazala da na farmi postoji genotip koji daje više mišićnog tkiva u butu za 1.521 kg [Px (♀LWxL): LWx (♀LWxL)] sa istom masom tople polutke, što je vrlo velika razlika. Sa istom prosečnom masom tople polutke, ženska grla su imala veću prosečnu masu buta i prinos mišićnog tkiva u poređenju sa kastriranim muškim životinjama. Zabeležen je uticaj genotipa ($P<0,001$) na sve ispitivane osobine, takođe, zabeležen je uticaj sezone rođenja na kožu i potkožno masno tkivo i na masu intermuskularne masti buta. Uticaj pola je bio značajan ($P<0,01$) na masu kože i potkožnog masnog tkiva i na masu mišićnog tkiva buta, ali nije primećen značajan uticaj na druga ispitivana svojstva ($P>0,05$).

Ključne reči: tovljenici, masno tkivo, koštano tkivo, mišićno tkivo buta

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