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VARIATION OF TRAITS OF FATTENERS UNDER THE IMPACT OF VARIOUS FACTORS

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Abstract: The aim of this study was to determine the effect of the sire breed, sire within sire breed, genotype of fatteners, gender of fatteners, gender within sire breed, season of birth of fatteners and mass of warm carcass side on the following traits: back fat thickness - middle of the back (DSL), back fat thickness – lower back (DSK), meat yield of carcass sides (JUSKG) and percentage/share of meat in carcass sides (JUSPRO). The research was conducted in the experimental slaughterhouse and laboratory of the Institute for Animal Husbandry, Belgrade-Zemun, and included females and castrated male animals. Sires of fatteners were pure breeds: Swedish Landrace (SL, n = 10), Large White (LW, n = 3) and Pietrain (P, n = 3), while the offspring belonged to the following genotypes: pure breed - Swedish Landrace (SL, n=252), and crosses of Large White × Swedish Landrace (LW × SL) (n=170), Pietrain × Swedish Landrace (P × SL) (n=13), [Pietrain × (Large White × Swedish Landrace)] P × (LW × SL) (n=35), [Swedish Landrace × (Large White × Swedish Landrace)] SL × (LW × SL) (n=33) and [Large White × (Large White × Swedish Landrace)] LW × (LW × SL) (n=33). The study included total 536 offspring of which 276 are male castrated and 260 female animals. In the winter 24 piglets were born, in the spring 95, in the summer 148 and autumn 269 piglets. It was established that the sire within sire breed Pietrain (S:P) does not affect the variation of the studied traits of fattening pigs ($P>0.05$); sire within sire breed Swedish Landrace (S:SL) does not affect the varying of the trait JUSPRO ($P>0.05$); season of birth within the Model 1 does not affect the traits yield and share of meat ($P>0.05$); the offspring gender within genotype (Gender : Genotype) does not affect the variation of fat thickness at the centre of the back ($P>0.05$). All other factors (sire breed, sire within the sire breed - Large White, gender and genotype of fattening pigs, gender within sire breed, the mass of warm carcass side, and also birth season of fattening pigs in the Model 2) included in the models showed statistically significant impact on the variability of traits of fattening pigs ($P<0.05$; $P<0.01$ and $P<0.001$).

Key words: sire, genotype, gender, season of birth, fattener

Introduction

Production of pigs and pork depends on many factors, the most important are the market and economic efficiency of production. The following factors which affect the quantity and quality of the pork carcass are price of fattened pigs, method of evaluation of breeding pigs (i.e. whether fatteners are paid per kilogram of live weight or meatiness established on the slaughter line), genetic and environmental factors (breed, origin, method of breeding, age and weight at slaughter, castration, nutrition, pig procedures before, during and after slaughter, etc.) *(Radović et al., 2009).* The total work in the field of genetics, selection, nutrition, reproduction and health care *(Radović et al., 2007)* are evaluated with the evaluation/assessment of the carcass side quality. Quality of meat within species can be influenced by the origin of the animals, the feed materials, slaughter and chilling procedures, storage conditions, muscle type, etc. (Stanišić et al., 2013). Indicators of lean meat are indicators of quality of pig carcasses and include various types of measurements, on different locations and carried out in different ways *(Kosovac et al., 2009).* The task of breeding/selection is to provide high-quality breeding animals and the quality pigs for slaughter industry and meat processing industry, based on a clearly defined breeding goal, which is always necessary to improve depending on customer preferences. The profitability of production depends on the success of the selection, which is particularly evident on large farms. The fundamental requirements for economical production of pigs are: increase of the annual production of fattening pigs per sow, reduced feed per kilogram of gain and increase of meat yield of fatteners *(Radović, 2012a).* Intensity of growth, food utilization and meat yield are of great importance in breeding and selection *(Radović et al., 2013).* Sire breed and sires within the same genotype influence the variability of carcass side quality in offspring *(Kosovac et al., 1998; Petrović et al., 2002; Radović et al. 2003; Pušić and Petrović, 2004).* Sires and offspring gender affect the variability of traits of offspring *(Petrović et al., 2006a).* By crossing of pigs the aim is to achieve heterosis effect for important production traits. Finding the best combination of crossing is a continuous process, given that the frequency of particular genes changes continuously through the selection *(Senčić et al., 2003).* Timely obtaining of feedback from the slaughter line and/or from the processing industry enables the breeder to evaluate the effects of breeding and selection work and make changes in the future work if there are such requirements of the meat industry and to achieve greater genetic gain medium and high heritability traits *(Petrović et al., 2004).*

Materials and Methods

Measuring of carcass quality traits was done on animals of both genders - the males were castrated, total of 536 pigs. The research included all four seasons of the birth of offspring in a single herd. The pigs come from 16 pure breed sires, namely: Swedish Landrace (SL) 10, Large White (LW) 3 and Pietrain (P) 3. Genotypes of fattening pigs that were included in this study were as follows: Swedish Landrace (SL) as a pure breed, and crosses Large White × Swedish Landrace, Pietrain × Swedish Landrace, [Pietrain × (Large White × Swedish Landrace)], [Swedish Landrace × (Large White × Swedish Landrace)] and [Large White × (Large White × Swedish Landrace)]. Pre-slaughter mass (weight at the end of fattening period) and warm carcass side weight were measured on a scale with an accuracy of ± 0.5 kg. Fat thickness was measured at the middle of the back (where the fat is the thinnest between the 13th and 15th thoracic vertebra) and the lower back above *m. gluteus medius* (measures taken at the spot where the *m. gluteus medius* penetrates into fat tissue). The sum of back fat thickness in the middle of the back and lower back represents the back fat thickness (*OG SFRY, 1985*). Fat thickness was measured by a steel ribbon, with a precision of ± 1 mm. To determine the yield (JUSKG) and the share of meat (JUSPRO) in carcass sides, based on realized measurements, the tables for meaty pigs were used, which are an integral part of the Rulebook on the quality of slaughtered pigs and pork categorization (*OG SFRY, 1985).*

Data analysis was performed using adequate computer package "LSMLMW and MIXMDL, PC-2 VERSION" *(Harvey, 1990)* i.e. the procedures of least squares method in order to determine the significance ($P<0.05$) of systematic influences on the traits of fat thickness on the lower back (DSK) back fat thickness at the middle of the back (DSL), yield and percentage of meat (JUSKG and JUSPRO). The models included: sire breed, sires within sire breed, genotype of the fattener, gender, gender within genotype, season of birth and weight of warm carcass sides (linear regression influence).

To test the variation of traits of fattening pigs the following models were used:

Model 1: $Y_{ijklm} = \mu + R_i + O_{j:i} + P_k + P_{k:i} + S_l + b_1 (x_1 - \square_1) + \varepsilon_{ijklm}$

where: Y_{ijklm} - μ = general population average, R_i – impact of sire breed (i=1, 2, 5); $O_{j:i}$ – impact of sires within the breed ($j{:}i_1$ =1, 2, 3, 7, 8, 9, 15, 16, 17, 18; $j{:}i_2$ =4, 5, 6; $j{:}i_3$=14, 19, 20); P_k – impact of gender (k =1,2); $P_{k:i}$ – impact of gender within breed; S_l – impact of birth season of progeny (l =1, 2, 3, 4); expression of trait of individual animal *m*, of boar breed *i*, of *j* sire within *i* breed, *k* gender and *l* birth season; b_1 – linear regression impact of weight of warm carcass side (x_1); ε_{ijklm} – random error (residue).

Model 2: $Y_{ijkl} = \mu + G_i + P_j + P_{j:i} + S_k + b_1 (x_1 - \square) + \varepsilon_{ijkl}$
gde je: Y_{ijkl} - μ = general population average; G_i – impact of genotype (i =1, 2, 5, 6, 8, 9); P_j – impact of gender (j=1,2); $P_{j:i}$ - impact of gender within breed; S_k - impact of birth season of progeny (k =1, 2, 3, 4); expression of trait of individual animal *l*, *i* genotype, *j* gender, *j* –gender within *i*- genotype, *k*-birth season; b_1 - linear regression impact of weight of warm carcass side (x_1); ε_{ijkl} - random error (residue).

Results and Discussion

All tested traits are adjusted to the same mass of warm carcass side (MTP), which is 81.20 kg. The average values and standard deviations of corrected properties are shown in Table 1.

Table 1. Mean values and standard deviations of growth traits and carcass quality of progeny

Trait		$\bar{X}$±SD
MTP	Weight of warm carcass side, kg	81.20 ±8.60
MPK	Final body mass of fatteners (pre-slaughter), kg	101.04±9.61
DSL	Back fat thickness – centre, mm	17.22 ±5.55
DSK	Back fat thickness – lower back, mm	15.96 ±6.15
JUSKG	Meat yield in carcass sides (OG SFRY, 1985), kg	35.39±3.70
JUSPRO	Meat percentage/share in carcass sides (OG SFRY, 1985), %	43.61±1.80

Pušić and Petrović (2004), have established in their study higher MTP (+10.65 kg), higher meat yield (+3.14 kg), but lower percentage of meat (41.95%), while *Petrović et al. (2006b)* have reported on a farm A MTP of 85.78 kg and on farm B MTP of 82.59 kg, and the percentage/share of meat on the farms of 43.28 and 43.91%, respectively, which is very similar to our results. Also, *Petrović et al. (2006a)* have reported value for JUSPRO of 43.27%, and that the sum of back fat thickness on the back and lower back, with MTP - 85.59 kg, of 37.20 mm, which is contrary to our results, where the sum of fat thickness was 33.18 mm, but at a lower MTP.

Table 2 shows the values of the fat thickness of bacon that are necessary in order to obtain the values for the yield (JUSKG) and the share of meat in the carcass side (JUSPRO) from the tables for meaty pigs, which are the integral part of the Rulebook on the quality of slaughtered pigs and pork categorization *(OG SFRY, 1985).* The difference between fat thickness at the middle of the back and lower back is 0.13 mm. Analysis of the data showed that the lowest values for fat thickness occur in the progeny of Pietrain sires (13.20 and 14.31 mm), which resulted in the highest yield (36.22 kg) and the share of meat (44.25%) of the carcass side. The highest values for fat thickness wer recorded in animals that originated from Large White sires (20.51 and 19.12 mm), and therefore the lowest values for yield and share of meat in carcass sides (34.59 kg and 42.73%). Within sire breed SL, the lowest value for trait DSL was recorded in progeny of boar No. 17 (11.78 mm), however with the highest percentage of meat (44.69%), while the progeny of boar No. 2 had the lowest value for the trait DSK (12.19 mm). By contrast, animals that come from the Sire No. 5, LW breed, had the thickest fat (22.25 and 21.37 mm), and the lowest yield and share of meat (33.92 kg and 41.94%). The regression effect of the mass of warm carcass side shows that the studied traits statistically very highly varied ($P<0.01$ and $P<0.001$). With the increase in body weight at the end of fattening by 1 kg, the fat thickness at the middle of the back and lower back increased by 0.246 mm and 0.244 mm, respectively, and meat yield of carcass sides by 0.382 kg. Contrary to the above traits, share/percentage of meat decreased by 0.019% per kilogram of increased mass of fatteners.

Table 2. The effect of sire breed, sires within the breed and MTP (Model 1) on fat thickness, yield and share/percentage of meat in carcass side (LSMean ±S.E.)

Sources of variation		DSL[2)], mm	DSK, mm	JUSKG, kg	JUSPRO, %
μ ± S.E.		16.21 ±0.43	16.08 ±0.46	35.54 ±0.14	43.65 ±0.15
RO[1)]	Sire No.				
Swedish Landraces	1	15.76±0.62	14.50±0.68	35.84±0.20	44.23±0.22
	2	14.52±0.63	12.19±0.69	36.04±0.21	44.46±0.22
	3	17.53±0.80	14.80±0.87	35.46±0.26	43.86±0.28
	7	15.70±1.61	16.40±1.75	35.29±0.53	43.34±0.56
	8	17.31±1.52	17.04±1.65	34.61±0.50	42.98±0.52
	9	14.98±1.62	13.30±1.76	35.27±0.53	43.80±0.56
	15	14.34±1.50	15.88±1.63	36.30±0.49	44.05±0.52
	16	14.43±1.40	16.45±1.51	36.09±0.46	44.14±0.48
	17	11.78±1.38	12.83±1.50	36.35±0.45	44.69±0.48
	18	13.04±1.30	14.73±1.41	36.92±0.42	44.10±0.45
	Average	14.94±0.56	14.81±0.61	35.82±0.18	43.96±0.19
Large White	4	20.07±0.62	18.16±0.67	34.82±0.20	43.00±0.21
	5	22.25±0.71	21.37±0.77	33.92±0.23	41.94±0.24
	6	19.20±0.66	17.84±0.71	35.04±0.21	43.25±0.23
	Average	20.51±0.48	19.12±0.52	34.59±0.16	42.73±0.17
Pietrain	14	15.24±0.89	12.48±0.97	36.54±0.29	44.64±0.31
	19	12.22±1.70	15.63±1.84	36.18±0.56	44.24±0.59
	20	12.14±1.62	14.83±1.76	35.94±0.53	43.86±0.56
	Average	13.20±1.01	14.31±1.09	36.22±0.33	44.25 ±0.35
MTP (b)		0.246[3)]***	0.244***	0.382***	-0.019**

[1)]RO-sire breed, MTP (b)- linear impact of the mass of warm carcass side(MTP=81,20 kg); [2)] DSL-fat thickness at the middle of back; DSK- fat thickness at the lower back; JUSKG- meat yield of carcass side; JUSPRO- share/percentage of meat in carcass side; 3) NS=P>0.05;*=P<0.05;**=P<0.01; ***=P<0.001

Considering of the progeny gender as a source of variation of investigated traits (Table 3), it was established that females had a lower value for DSL (-3.39 mm) and DSK (-3.52 mm) compared to male castrated animals and thus greater value of the yield (+0.83 kg) and the share of meat (+ 1.10%). The study of the progeny gender within the sire breed showed that males within sire breed LW had the highest value for DSL (22.99 mm) and DSK (22.12 mm), thus these animals had the lowest yield (33.71 kg) and the share of meat (41.67 %) in the carcass sides. Female animals within the breed P had the lowest value for trait DSL (12.19 mm), but they had the highest yield and the percentage of meat (36.38 kg and 44.47%). Looking at the season of birth of progeny, it was found that offspring born in the winter had the thinnest back fat (14.16 and 14.59 mm), and the highest values for yield and share/percentage of meat (35.89 kg and 44.01%).

Table 3. The average values of the properties DSL, DSK, JUSKG and JUSPRO within factors gender, gender within sire breed and season of birth (Model 1)

Sources of variation		DSL[2)], mm	DSK, mm	JUSKG, kg	JUSPRO, %
Gender	M[1)]	17.91±0.48	17.84±0.52	35.13±0.16	43.10±0.17
	Ž	14.52±0.51	14.32±0.55	35.96±0.17	44.20±0.18
Gender within sire breed	M:ŠL	16.54±0.59	16.70±0.64	35.62±0.19	43.60±0.20
	Ž:ŠL	13.34±0.64	12.93±0.70	36.02±0.21	44.33±0.22
	M:VJ	22.99±0.57	22.12±0.62	33.71±0.19	41.67±0.20
	Ž:VJ	18.02±0.56	16.13±0.61	35.47±0.18	43.79±0.19
	M:P	14.21±1.15	14.72±1.25	36.06±0.38	44.02±0.40
	Ž:P	12.19 ±1.22	13.91 ±1.32	36.38 ±0.40	44.47±0.42
Season	Winter	14.16±1.16	14.59±1.26	35.89±0.38	44.01±0.40
	Spring	18.88±0.68	18.75±0.74	35.09±0.22	43.21±0.24
	Summer	16.00±0.69	15.10±0.75	35.73±0.23	43.76±0.24
	Autumn	15.82±0.64	15.89±0.70	35.47±0.21	43.60±0.22

1)M- castrated males, Ž–females; 2)DSL- fat thickness at the middle of back; DSK- fat thickness at the lower back; JUSKG- meat yield of carcass side; JUSPRO- share/percentage of meat in carcass side

Table 4 shows the average values for the traits of fattening pigs (DSL, DSK, JUSKG and JUSPRO) within the factors - genotype, gender, season of birth and MTP (Model 2). Thinnest fat - DSL was recorded in fatteners of genotype 6 (13.71 mm) i.e. three breed crosses with Pietrain as a terminal breed [Px (LWxSL)]. The thinnest fat - DSK (12.59 mm), and the highest yield and the share/percentage of meat (36.63 kg and 44.82%) were recorded in animals of genotype 5 (two breed crosses with 50% of genes of breed P). Contrary to them, fatteners of genotype 9 [LWx (LWxSL)] had the highest values of fat thickness (20.54 and 19.61 mm) and the lowest yield (34.45 kg) and the share of meat (42.50%) at the same average mass of warm carcass sides. The gender of fattening pigs and season of birth displayed the same tendency as in Model 1. Females had more meat in the carcass sides (36.09 kg and 44.36%) and thinner back fat than castrated males, which is in line with the research of *Petrović et al. (2006b)*. Fatteners born during the winter had the thinnest fat and the most meat in the carcass side. Contrary to them, animals born during the spring, had the highest mean values for fat thickness and the lowest for meat yield of carcass sides. The regression effect of the mass of warm carcass side showed statistically significant and very high varying of traits (P<0.05 and P<0.001). With the increase in body weight at the end of fattening by 1 kg, the fat thickness at the middle of the back and lower back increased by 0.229 mm and 0.246 mm, respectively, and meat yield of the carcass sides by 0.378 kg. Contrary to the above traits, share/percentage of meat decreased by 0.020% per kilogram of increased mass of fatteners.

Table 4. The effect of genotype, gender, season and MTP (Model 2) on fat thickness, yield and share/percentage of meat in carcass side (LSMean ±S.E.)

Source of variation		DSL[3)], mm	DSK , mm	JUSKG, kg	JUSPRO, %
μ ± S.E.		16.93±0.36	15.67±0.39	35.61 ±0.12	43.76± 0.12
Genotype	1[1)]	14.94±0.36	13.80±0.39	35.94±0.12	44.28± 0.12
	2	19.77±0.45	19.13±0.49	34.75±0.15	42.85± 0.16
	5	15.22±1.25	12.59±1.36	36.63±0.41	44.82± 0.43
	6	13.71±0.87	12.95±0.95	36.46±0.29	44.61± 0.30
	8	17.42±0.82	15.92±0.90	35.44±0.27	43.50± 0.28
	9	20.54±0.80	19.61±0.87	34.45±0.26	42.50± 0.27
Gender	M[2)]	18.58±0.49	17.52±0.54	35.13±0.16	43.16 ±0.17
	Ž	15.29±0.46	13.82±0.50	36.09±0.15	44.36 ±0.16
Season	Winter	14.86±0.99	13.28±1.08	36.17±0.33	44,46 ±0,34
	Spring	19.13±0.54	19.74±0.59	34.91±0.18	42,86 ±0,19
	Summer	16.75±0.48	14.63±0.52	35.89±0.16	43,99 ±0,16
	Autumn	16.99±0.39	15.01±0.42	35.49±0.13	43,73 ±0,13
MTP (b)		0,229[4)]***	0.246***	0.378***	-0.020*

[1)]1-ŠL, 2- VJxŠL, 5-PxŠL, 6- Px(VJxŠL), 8- ŠLx(VJxŠL), 9- VJx(VJxŠL); [2)]M-castrated males, Ž–females, MTP(b)- linear effect of the mass of warm carcass side; [3)] DSL- fat thickness at the middle of back; DSK- fat thickness at the lower back; JUSKG- meat yield of carcass side; JUSPRO-share/percentage of meat in carcass side; [4)] NS=P>0.05;*=P<0.05;**=P<0.01; ***=P<0.001

The statistical significance of the factors included in the Models 1 and 2, when analysing the traits of fat thickness, yield and share of meat in the carcass sides, are shown in Table 5.

Table 5. Statistical significance (significance level) of the impact of factors included in the models (Model 1 and 2) when analyzing the traits of fat thickness and meat yield (OG SFRY,1985)

Sources of variation (impact)[1]		DSL[2]	DSK	JUSKG	JUSPRO
Model 1	RO	***[3]	***	***	***
	O:ŠL	**	**	**	NS
	O:VJ	***	***	***	***
	O:P	NS	NS	NS	NS
	Gender	***	***	***	***
	Season	*	*	NS	NS
	Gender:RO	*	***	***	***
	MTP (b)	***	***	***	**
	R^2	0,442	0,465	0,865	0,366
Model 2	Genotype	***	***	***	***
	Gender	***	***	***	***
	Season	***	***	***	***
	Gender:Genotype	NS	*	***	***
	MTP (b)	***	***	***	*
	R^2	0,395	0,416	0,852	0,316

[1]RO-sire breed, O:ŠL-sires within Swedish Landrace sire breed, O:VJ-sires within Large White sire breed, O:P- sires within Pietrain breed, Gender:RO-gender of progeny within sire breed, Gender:Genotype- gender of progeny within genotype; [2] DSL- fat thickness at the middle of back; DSK- fat thickness at the lower back; JUSKG- meat yield of carcass side; JUSPRO- share/percentage of meat in carcass side; MTP (b)- linear effect of the mass of warm carcass side; [3] NS=P>0.05;*=P<0.05;**=P<0.01; ***=P<0.001

From Table 5 (Model 1) it can be seen that the sire breeds, siress within the LW breed and gender of fatteners influenced statistically high (P<0.001) variation of all traits of offspring. However, variation of any traits (P>0.05) was not determined between the progeny from different sires of breed P. Sires of SL breed showed statistically highly significant effect (P<0.01) on all traits except for JUSPRO (P>0.05). Season of birth of progeny significantly affected fat thickness (P<0.05), but had no influence on the properties of yield and share of meat, while by applying the Model 2, season showed statistically high varying of all the studied traits (P<0.001), as well as the genotype (P<0.001). The obtained differences in the mean values for all traits between females and male castrated animals were statistically highly significant (P<0.001) in both models used. The values of the coefficient of determination for Model 1, were in the range of 0.366 (JUSPRO) to 0.865 (JUSKG). The coefficient of determination R^2 showed that the effects included in Model 1 (sire breed, sires within the breed, gender, season and gender within sire breed) explained 44.2% of variation of DSL, 46.5% of the variation of DSK, 86.5% of the variation of JUSKG, and 36.6% of the variation of

JUSPRO. The coefficient of determination R^2 showed that the effects included in Model 2 (genotype, gender, season and gender within genotype) explained 39.5% of variation of DSL, 41.6% of the variation of DSK, 85.2% of the variation of JUSKG, and 31.6% of the variation of JUSPRO. So, by using the effect of factors the variation of JUSKG is explained the most, in both applied models, whereas variation of trait JUSPRO is explained the least in both models. *Pušić and Petrović (2004)* have reported that the sire breed, gender of progeny and MTP significantly affect the variation of all traits of fattening pigs, which is in line with our research. Sire breed affects all traits of offspring on one farm, while on the other farm, sire breed has no influence on the properties of JUSKG and JUSPRO *(Petrović et al., 2006b* which is contrary to our results. The results of this research showing highly statistically significant impact of gender on carcass side quality traits are consistent with a greater number of researchers *(Petrović et al., 2004; Pušić and Petrović, 2004; Petrović et al., 2006a; Petrović et al., 2006b; Radović et al., 2007; Radović et al., 2012b),* but not in line with the research *Kosovac et al. (1998)* and *Radović et al. (2009)* who have found no statistically significant differences between the genders. Contrary to our research *Radović et al. (2009)* suggest that sire breed has no influence on the variability of traits DSK and JUSPRO.

Conclusion

On the basis of the obtained results it was established that sire breed, gender of fatteners and genotype highly significantly affected all studied traits of fattening pigs ($P<0.001$). Sires within LW statistically highly influenced the variation of all traits of fattening pigs ($P<0.001$), and contrary to them, sires within the breed P had no impact on the variability of traits of their offspring ($P>0.05$). Sires within SL significantly affected the variation of all traits ($P<0.01$), with the exception of the trait JUSPRO. Applying the Model 1, season of birth of offspring exerted influence only on the properties of fat thickness ($P<0.05$), while the application of the Model 2 resulted in very high statistical impact on variation of all traits of fattening pigs ($P<0.001$). By using both models, MTP showed very high statistically significant impact on the variability of traits of fattening pigs ($P<0.001$), except for the trait JUSPRO which had a lower impact ($P <0.01$ and $P <0.05$). Increasing the MTP by 1 kg resulted in an increase in values for all traits of fattening pigs, except for the trait JUSPRO which decreased.

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Rezime

Cilj ovog istraživanja je da se utvrdi uticaj rase oca, oca unutar rase oca, genotipa tovljenika, pola tovljenika, pola unutar rase oca, sezone rođenja tovljenika i mase tople polutke na sledeće osobine tovljenika: debljina slanine na sredini leđa (DSL), debljina slanine na krstima (DSK), prinos mesa u polutkama (JUSKG) i udeo mesa u polutkama (JUSPRO). Istraživanje je obavljeno u eksperimentalnoj klanici i laboratoriji Instituta za stočarstvo, Zemun-Beograd, kojim su obuhvaćena ženska grla i muška kastrirana grla. Očevi tovljenika pripadaju čistim rasama: švedski landras (ŠL, n=10), veliki jorkšir (VJ, n=3) i pijetren (P, n=3), dok potomci pripadaju sledećim genotipovima: od čistih rasa zastupljen je švedski landras (ŠL), a od meleza javljaju se veliki jorkšir × švedski landras (VJ×ŠL), pijetren×švedski landras (P×ŠL), [pijetren×(veliki jorkšir×švedski landras)] P×(VJ×ŠL), [švedski landras×(veliki jorkšir×švedski landras)] ŠL×(VJ×ŠL) i [veliki jorkšir×(veliki jorkšir×švedski landras)] VJ×(VJ×ŠL). Utvrđeno je da otac unutar rase oca pijetren (O:P) ne utiče na variranje ispitivanih osobina tovljenika (P>0,05); otac unutar rase oca švedski landras (O:ŠL) ne utiče na variranje osobine JUSPRO (P>0,05); sezona rođenja tovljenika ne utiče u okviru Modela 1 na osobine prinos i udeo mesa (P>0,05); pol potomaka unutar genotipa (Pol:Genotip) ne utiče na variranje debljine slanine na sredini leđa (P>0,05). Svi ostali faktori uključeni u modele su pokazali statistički značajan uticaj na variranje osobina tovljenika (P<0,05; P<0,01 i P<0,001).

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