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# REGRESSION BETWEEN BODY WEIGHT OF LAMBS FROM BIRTH TO WEANING IN VARIOUS STRAINS OF SHEEP PRAMENKA

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The result of the multiple regression coefficient (R) have the following values: 0.582 in the Pirot race, 0.499 in the Svrljiska race, 0.610 in the Sjenica race and 0.580 in the Sharplanina race. The coefficient of multiple determination (R2) had the following values: 0.339 in Pirot, 0.249 in Svrljiska, 0.372 in Sjenica and 0.337 in Sharplanina sheep. It follows from this that according to the order of genotypes shown, 33.9%; 24.4%; 36.8%; and 33.2% of the variance of the body weight of lambs at 90 days, determined by the variance of the set of the following variables: PI, SV, SJ, SP- at 60, 30 and 1 day. The adjusted coefficient of multiple determination (Adjusted R2) had the following values: 0.335 in Pirot, 0.244 in Svrljiska, 0.368 in Sjenica and 0.332 in young Sharplanina sheep. From this it follows that according to the order of genotypes shown, 33.5%; 24.4%; 36.8% and 33.2% of the variance of the body weight of lambs at 90 days, determined by the variance of a set of predictor variables: PI, SV, SJ, SP- at 60, 30 and 1 day.

*Keywords:* pramenka sheep, body weight, regression

## INTRODUCTION

In the sheep breeding, we often encounter the fact that there is a certain interdependence between individual quantitative traits. The degree of this relationshep is determined by correlation and regression analysis and differs from trait to trait. Regression shows, in absolute units for a given property (kg, cm), how much another property changes in a positive or negative direction if the first one has changed by a unit of measurement. Unlike correlation, which is bidirectional, regression must have a logical direction of cause. Therefore, in regression, the independent variable (x) and the dependent variable (y) should be distinguished, and this analysis should be applied only when the influence of one characteristic on another is important,

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i.e. when, based on the measured value of one characteristic, the quantity of another is to be determined.

Regression analysis of experimental lambs in growth was performed by MEYER (1997); LEWIS and BROTHERSTONE (2002); FOGARTY (2003); FISCHER *et al*. (2004) under commercial farm conditions. These studies have shown significant variations in body mass and their interrelationships.

CARO PETROVIĆ *et al*. (2013) investigated the linear relationship between growth characteristics of Sharplanin lambs. The values they reached for the coefficients: multiple regressions (0.712), determinations (0.507) and adjusted coefficient (0.506).

## MATERIALS AND METHODS

Investigation was carried out in eastern, southern and south-western Serbia, more precisely in the areas where most pramenka is grown. Mating of sheep was in season from June to September and ewes lambing began in December and further prolonged during the winter period.

In breeding of lambs, applied technology is that after ten days after birth, the offspring is separated from their mothers with the possibility of sucking twice during the day. Then, feeding with hay and concentrate mixture for lambs starts. These nutrients were available up to the age of 90 days.

The material for the research included four strains (Pirot, Svrljig, Sjenica, Sharplanina) of Pramenka sheep. In each strain of sheep, mothers were divided into three groups according to their age (1- two years old; 2- three years old, 3- four years old). All experimental animals were properly marked and recorded. Data processing included a total of 1800 lambs (450 lambs per strain of Pramenka sheep).

Research was conducted during the period of three years, according to a pre-established plan. In each year of the experiment, body weight of lambs of all genotypes was measured at the time of birth and 30, 60 and 90 days of age. The measurement was carried out by scale with accuracy of 0.10 kg and all data was used for statistical analysis by using SPSS (Statistical Package for the Social Sciences) statistical software, 20 (2012).

## RESULTS AND DISCUSSION

Body weight of lambs at three months is a key aspect of these trials. In order to determine the size of the changes that would occur in the body mass at 90 days depending on the change in the weight of the lambs from birth to 60 days, we will analyze the results of the multivariate regression analysis, which are shown in the following tables.

The values of the multiple regression coefficient (R) given in Table 1 have the following values: 0.582 for Pirot, 0.499 for Svrljiska, 0.610 for Sjenica and 0.580 for Sharplanina race. The above values show correlations between the mass values of lambs of the tested genotypes at 90 days and the set of variables (PI, SV, SJ, SP-60, 30, 1) given in the model.

In Table 1, it can be observed that the coefficient of multiple determination (R2) had the following values: 0.339 for Pirot, 0.249 for Svrljiska, 0.372 for Sjenica and 0.337 for Sharplanina sheep. It follows from this that according to the order of genotypes shown, 33.9%;

24.4%; 36.8%; and 33.2% of the variance of the body weight of lambs at 90 days, determined by the variance of sk upa of the following variables: PI, SV, SJ, SP- with 60, 30 and 1 day.

*Table 1. Regression coefficients and multiple determinations*

| Genotype | Model | R | R2 | Adjusted R2 | Standard error of estimate |
|---|---|---|---|---|---|
| PI | 1 | .582[a] | .339 | .335 | 1.97900 |
| SV | 1 | .499[a] | .249 | .244 | 2.66907 |
| SJ | 1 | .610[a] | .372 | .368 | 2.16158 |
| SP | 1 | .580[a] | .337 | .332 | 2.21682 |

a. Predictors: (Constant), PI, SV, SJ, SP- 60, 30, 1

b. Dipendent variable: PI, SV, SJ, SP- 90

The above table also shows that the adjusted coefficient of multiple determination (Adjusted R2) had the following values: 0.335 for Pirot, 0.244 for Svrljiska, 0.368 for Sjenica and 0.332 for young Sharplanina sheep. From this it follows that according to the order of genotypes shown, 33.5%; 24.4%; 36.8% and 33.2% of the variance of the body weight of lambs at 90 days, determined by the variance of a set of predictor variables: PI, SV, SJ, SP- at 60, 30 and 1 day.

*Table 2. Parameters of variance analysis depending on the observed genotype*

| Genotype | Model | | Sum of squares | Df | Average of squares | F | Sig. |
|---|---|---|---|---|---|---|---|
| PI | 1 | Regression | 896.449 | 3 | 298.816 | 76.298 | .000[b**] |
| | | The rest | 1746.740 | 446 | 3.916 | | |
| | | Total | 2643.189 | 449 | | | |
| SV | 1 | Regression | 1051.234 | 3 | 350.411 | 49.188 | .000[b**] |
| | | The rest | 3177.273 | 446 | 7.124 | | |
| | | Total | 4228.508 | 449 | | | |
| SJ | | Regression | 1235.800 | 3 | 411.933 | 88.163 | .000[b**] |
| | 1 | The rest | 2083.904 | 446 | 4.672 | | |
| | | Total | 3319.705 | 449 | | | |
| SP | | Regression | 1112.255 | 3 | 370.752 | 75.444 | .000[b**] |
| | 1 | The rest | 2191.768 | 446 | 4.914 | | |
| | | Total | 3304.022 | 449 | | | |

a. Dipendent variable: MA90

b. Predictors: (Constant), Weight 60, 30, 1

* Significant at the P≤ 0.05 level

**. Significant at the P≤ 0.01 level

The values for the F-test (Table 2) had the following values: 76.298 (Sig.**) for Pirot, 49.188 (Sig.**) for Svrljiska, 88.163 (Sig.**) for Sjenica and 75.444 (Sig.**) ) in Sharaplanina lambs. It follows from this that the multiple correlation coefficients are statistically very significant for all genotypes. This leads to the conclusion that the regression model statistically significantly predicts the body mass values of lambs at 90 days of age.

*Table 3. Values of the regression coefficient depending on the genotype of the lambs*

| Model | | non-standard coefficients | | standardized coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | SE | Beta | | |
| 1 | (Constant) | 8.916 | .779 | | 11.441 | .000** |
| | PI1 | 1.048 | .165 | .269 | 6.352 | .000** |
| | PI30 | .814 | .084 | .412 | 9.741 | .000** |
| | PI60 | .015 | .019 | .031 | .780 | .436 |
| 1 | (Constant) | 10.904 | 1.321 | | 8.255 | .000** |
| | SV1 | 1.314 | .259 | .234 | 5.071 | .000** |
| | SV30 | .675 | .102 | .322 | 6.624 | .000** |
| | SV60 | .101 | .093 | .052 | 1.087 | .278 |
| 1 | (Constant) | 8.481 | 1.012 | | 8.377 | .000** |
| | SJ1 | 1.301 | .192 | .304 | 6.769 | .000** |
| | SJ30 | .317 | .071 | .194 | 4.482 | .000** |
| | SJ60 | .444 | .077 | .260 | 5.769 | .000** |
| 1 | (Constant) | 7.212 | .899 | | 8.025 | .000** |
| | SP1 | 1.401 | .195 | .310 | 7.204 | .000** |
| | SP30 | .268 | .073 | .163 | 3.670 | .000** |
| | SP60 | .393 | .063 | .275 | 6.275 | .000** |

a. dependent variables: PI90, CV90, SJ90, SP90

* Significant at the P≤ 0.05 level

**. Significant at the P≤ 0.01 level

Table 3 shows the final results of the multiple regression for all tested genotypes of lambs.

Based on the results from the table, it is possible to point out that the increase in body weight of lambs from birth to 60 days of age is correlated with the increase in body weight at 90 days. This means that an increase in the birth weight of lambs by 1 kg causes an increase in the body weight

of lambs at 90 days by: 1,048 kg (Pirot); 1,314 kg (Svrljig); 1,301 kg (Sjenica); 1,401 kg (Sharplanina) population.

Based on the presented results of the multiple regression research, it follows that there are no great differences in the linear association of lamb growth characteristics depending on the genotype. The linear relationship between lamb body weight characteristics at 90 days of age and body weight at birth, at 30 and 60 days, varies within the medium range.

The obtained results of the research provide information that 33% of the variability of the body weight of lambs of all genotypes at the age of 90 days belongs to body weight variations from birth to 60 days of age. Based on these results, it can also be seen that the other 67% of the variability belongs to the influence of hereditary factors and the growing environment.

The group of authors (SCHINCKEL *et al*., 2003, 2004; WANG and ZUIDHOF, 2004) suggests that researching the linear relationship of lamb growth traits greatly increases the chance of improving lamb body mass performance through selection, which is in line with the goals of our research.

LEWIS and BROTHERSTONE (2002) as well as FISCHER *et al*., (2004) state that the body mass of lambs in the third month of age is determined by the body mass in the previous stages of development, which is in agreement with our research.

Regression analysis of experimental lambs in growth was performed by MEYER (1997); LEWIS and BROTHERSTONE (2002); FOGARTY (2003); FISCHER *et al*. (2004) under commercial farm conditions. These studies showed significant variations in body mass and their interrelationship, which is in agreement with the results of our research.

CARO PETROVIĆ *et al*. (2013) investigated the linear relationship between growth characteristics of Sharplanina lambs. The values they reached for the coefficients: multiple regressions (0.712), determinations (0.507) and the adjusted coefficient (0.506) were slightly higher compared to the results of our research.

Also, in the work of CARO PETROVIĆ *et al*. (2013) an increase in the birth weight of lambs by 1 kg causes an increase in the body weight of lambs at 90 days by a slightly higher value of the observed unit compared to our data. The reason for some discrepancies with our results lies primarily in differences in the selection and size of the sample for analysis. However, it is important that the same trend of linear association was determined in both studies.

Other authors including LEWIS and BROTHERSTONE (2002), MORENO *et al*. (2003), FISHER *et al*. (2004), SAFARI *et al*. (2005), MIRAEI-ASHTIANI *et al*. (2007), RASHIDI *et al*. (2008), GOWANE *et al*. (2010), MOHAMMADI *et al*. (2010), PETROVIĆ *et al*. (2012), CARO PETROVIĆ *et al*. (2012), similar to our research, state the influence and the significance of the relationship between growth characteristics of lambs. The importance of this problem and very interesting results are also presented by BROMLEY *et al*. (2001).

## CONCLUSION

The multiple regression coefficient (R) have the following values: 0.582 for the Pirot, 0.499 for the Svrljiska, 0.610 for the Sjenica and 0.580 for the Sharplanina race. The coefficient of multiple determination (R2) had the following values: 0.339 in Pirot, 0.249 in Svrljiska, 0.372 in Sjenica and 0.337 in Sharplanina sheep. It follows from this that according to the order of

genotypes shown, 33.9%; 24.4%; 36.8%; and 33.2% of the variance of the body weight of lambs at 90 days, determined by the variance of the set of the following variables: PI, SV, SJ, SP- at 60, 30 and 1 day. The adjusted coefficient of multiple determination (Adjusted R2) had the following values: 0.335 in Pirot, 0.244 in Svrljiška, 0.368 in Sjenica and 0.332 in young Šarplanina sheep. From this it follows that according to the order of genotypes shown, 33.5%; 24.4%; 36.8% and 33.2% of the variance in body weight of lambs at 90 days, determined by the variance of a set of predictor variables: P I, SV, SJ, SP- with 60, 30 and 1 day. The values for the F-test (table 2) had the following values: 76.298 (Sig.**) for Pirot, 49.188 (Sig.**) for Svrljiska, 88.163 (Sig.**) for Sjenica and 75.444 (Sig.**) ) in Sharaplanina lambs. It follows from this that the multiple correlation coefficients are statistically very significant for all genotypes. This leads to the conclusion that the regression model statistically significantly predicts the body mass values of lambs at 90 days of age.

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# REGRESIJA IZMEĐU TELESNE MASE JAGNJADI OD ROĐENJA DO ODBIJANJA KOD RAZLIČITIH SOJEVA PRAMENKI

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Izvod

Vrednosti koeficijenta višestruke regresije (R) imaju sledeće vrednosti: 0,582 kod pirotske, 0,499 kod svrljiške, 0,610 kod sjeničke i 0,580 kod šarplaninske rase. Koeficijent multiple determinacije (R2) imao vrednosti: 0,339 kod pirotske, 0,249 kod svrljiške, 0,372 kod sjeničke i 0,337 kod šarplaninske ovce. Iz ovoga sledi da je po prikazanom redosledu genotipova 33,9%; 24,4%; 36,8%; i 33,2% varijanse telesne mase jagnjadi sa 90 dana, određeno varijansom skupa sledećih varijabli: PI, SV, SJ, SP- sa 60, 30 i 1 dan. Prilagođeni koeficijent multiple determinacije (Prilagođen R2) imao sledeće vrednosti: 0,335 kod pirotske, 0,244 kod svrljiške, 0,368 kod sjeničke i 0,332 kod podmlatka šarplaninske ovce. Odavde proizilazi da je po prikazanom redosledu genotipova, 33,5%; 24,4%; 36,8% i 33,2% varijanse telesne mase jagnjadi sa 90 dana, određeno varijansom skupa prediktorskih varijabli: PI, SV, SJ, SP- sa 60, 30 i 1 dan.

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