

GENOTYPE, SEX AND INTERACTION EFFECT ON LAMB GROWTH TRAITS

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Abstract: The pure breeds and crossing have an important role in production. It is essential in sheep meat production to maintain the genetic diversity of the adapted breeds, pure breeds and their crosses. Objective of the study is to determine the impact of genotype and sex on growth traits of lambs. Results of the study showed that male of all genotypes were dominant on body weight in all ages (from BWB to BW90). The highest birth weight (BWB) got male of genotype 2 (W). The lowest body weight at birth was the female lambs of genotype 1 (P). Body weights at ages 30, 60 and 90 days, male and female of genotype 4 (PxWxF) were dominant among other genotypes. Genotype 1 (P) of both sexes had the lowest bodyweights in all ages (BWB, BW30, BW60, BW90). The result showed better growth efficiency from males compared with females. The results of fixed factors and its impact on body weights of lambs showed very significant effect of genotype ($P < 0.01$) on body weights of lambs at birth (BWB), ages 30, 60 and 90 days (BW30, BW60, BW90). The effect of sex had highly significant effects ($P < 0.001$) on all ages. The interaction between genotype x sex showed a very significant effect ($P \leq 0.01$) on body weight at birth (BWB) but were not significant ($P \geq 0.05$) on body weights of lambs at ages BW30, BW60 and BW90. Superiority on growth traits of genotype 4 (PxWxF) at ages 30, 60 and 90 days, indicating that three-bred crossing resulted in high growth traits.

Key words: genotype, sex, interaction effect, growth traits, body weights, lamb

Introduction

Breed differences in performance characteristics are important genetic resources for improving efficiency of sheep meat production (Demekke *et al.*, 2004). Breed diversity is a valuable resource for sheep industry. Pure breeds and crossings

have significant role in production (*Pajor et al., 2009*). Crossbreeding systems utilize breed diversity to increase productivity comparable to purebred flocks (*Petrovic et al., 2011; Fathala et al., 2014*). In sheep meat production, it is essential to maintain the genetic diversity of the adapted breeds as well as the pure breeds and their crosses with recognized meat breeds (*De Vargas et al., 2014*).

The growth of lambs during the periods from birth to weaning is particularly highly conditioned by the genotype, accessible food-milk, hay, concentrate, in other words the ambience in which the young organism develops (*Bathaei and Leroy, 1998; Burfening and Kress, 1993; Gardner et al., 2007; Caro Petrovic et al., 2013; Ilic et al., 2013*). The bodyweight at birth had determined by numerous factors, genetic and paragenetic nature (*Petrovic et al., 2009*).

A great number of different factors influence the growth of lambs while nutrition, health condition and genotype belong to the most important ones. Other factors that can influence the growth ability of lambs to a greater or lesser extent are for example sex, litter size, month or season of lambing, age of dam and year of lamb birth (*Kuchtík and Dobeš 2006*). Sex hormones also influence the growth pattern of lambs (*Cloete et al., 2012*). The growth advantage of male lambs is attributed to the presence of testicular hormones, particularly testosterone (*Scanbacher et al 1980; Cloete et al., 2012*). Good mothering ability, easy lambing, high twinning rate is required from the ewes, nevertheless the mothers should be able to produce milk of sufficient quantity and quality, in order to achieve good lamb growth (*Csizmar et al., 2013*).

Considering the above mentioned the aim of this study is to evaluate the influence of genotype and sex on growth traits of lambs.

Material and Methods

The research was executed in the region of Stara Planina Mountain and at the experimental farm of the Institute for Animal Husbandry. In the evaluation of the growth traits, data from 200 heads per genotype were utilized (100 male, 100 female lambs) of the following:

- Purebred: Pirot Pramenka (P) as genotype 1, Wurtemberg (W) as genotype 2
- Crossbred F1 generation: Pirot x Wurtemberg (PxW) as genotype 3, (Pirot x Wurtemberg) x Il de France (PxWxF) as genotype 4.

All the lambs had weighed at birth and every 30 days intervals thereafter. For the determination of lambs' growth traits, the body weights considered for this study were: the weight at birth (BWB), at the age of 30 days (BW30), 60 days (BW60) and at 90 days (BW90) of the above mentioned genotypes.

The lambs was driven by technology two times short suckling milk with their mothers during the day and also supplemented with alfalfa hay including a

concentrate mixture for lambs with 18% protein. Feeding of lambs had been ad libitum up to 90 days of age.

Statistical analysis was performed by the GLM procedure of Statistical Package for the Social Sciences (SPSS) version 20.

Results and Discussion

Means and standard errors of body weights (BW) according to genotype of lambs are presented in Tables 1 and 2. The results of this study showed that male of all genotypes were dominant on body weight in all ages (from BWB to BW90). In table 1, the highest birth weight (BWB) got male of genotype 2 with the following differences: 1.09 kg - 1.20 kg; 0.49 kg - 0.75 kg; 0.31 kg - 0.57 kg from male and female of genotypes 1; 3; 4 and a difference of 0.62 kg from female of same genotype. Male of genotype 4 got the second place on BWB followed by male of genotype 3 and female lambs of genotypes 4, 2 and 3. The lowest body weight at birth, the female lambs of genotype 1.

Table 1. Mean values of purebred and crossbred lambs' body weight at birth and 30 days, kg

Genotype	Sex	BWB		BW30	
		Mean	±SE	Mean	±SE
P (1)	Male	3.70	0.05	9.71	0.15
	Female	3.59	0.04	9.24	0.17
W (2)	Male	4.79	0.12	11.27	0.23
	Female	4.17	0.09	10.39	0.24
PxW (3)	Male	4.30	0.07	11.13	0.16
	Female	4.04	0.05	10.84	0.15
PxWxF (4)	Male	4.48	0.06	13.32	0.15
	Female	4.22	0.05	12.43	0.12

Table 2. Mean values of purebred and crossbred lambs' body weight at 60 days and 90 days, kg

Genotype	Sex	BW60		BW90	
		Mean	±SE	Mean	±SE
P (1)	Male	15.48	0.16	22.68	0.33
	Female	14.50	0.19	21.25	0.32
W (2)	Male	19.59	0.35	28.16	0.20
	Female	18.62	0.40	27.24	0.21
PxW (3)	Male	18.79	0.29	26.88	0.33
	Female	18.28	0.31	26.22	0.27
PxWxF (4)	Male	22.65	0.39	33.11	0.29
	Female	21.37	0.31	31.28	0.24

Looking at the body weights at 30, 60 and 90 days of age, male and female of genotype 4 were dominant among other genotypes (table 2). Leading on body weights at ages 30, 60 and 90 days, the male lambs' of genotype 4. The differences on body weights with other genotypes (1, 2, 3) of both sexes (male-female) at age 30 days were: 3.61 kg - 4.08 kg, ; 2.05 kg – 2.93 kg, 2.19 kg – 2.48 kg. The difference from female of the same genotype was 0.9 kg. At age 60 days were 7.17 - 8.15kg, 3.06 – 4.03 kg, 3.86 -4.37 kg and a difference of 1.28 kg with female of same genotype.

At 90 days of age, the differences were 10.43- 11.86 kg, 4.95-5.87 kg, 6.23- 6.89 kg with female of same genotype a difference of 1.83 kg.

In tables, 1 and 2 indicating that genotype 1 (P) of both sexes had the lowest body weights in all ages (BWB, BW30, BW60, BW90), which is in agreement with results obtained by *Petrovic et al., (2011)*.

It can be noticed as well that the ranking of lambs' genotype were consistent with the levels of heterozygosity. The result of *Mohammadi et al., (2010)*; *De Vargas et al., (2014)*, showed better growth efficiency from males compared with females was in accordance with the result we had obtained. Relevant with our result was that an additional remark by *Mohammadi et al., (2010)*, the differences in sexual chromosomes probably in the position of genes related growth physiological characteristics, difference in endocrinal system (type and measure of hormone secretion especially sexual hormones) lead to difference of animal growth.

Table 3. Results of testing fixed factors and its impact on the body weight of lambs

Factor	Traits	Sum squares	df	Average squares	F	P
Genotype	BWB	79.866	3	26.622	49.015	0.000**
	BW30	1169.734	3	389.911	122.051	0.000**
	BWB60	4980.492	3	1660.164	172.392	0.000**
	BWB90	10611.933	3	3537.311	457.148	0.000**
Sex	BWB	19.406	1	19.406	35.730	0.000**
	BW30	79.493	1	79.493	24.883	0.000**
	BWB60	173.893	1	173.893	18.057	0.000**
	BWB90	292.457	1	292.457	37.796	0.000**
interaction genotype x sex	BWB	6.674	3	2.225	4.096	0.007**
	BW30	13.414	3	4.471	1.400	0.242 ^{n.s.}
	BWB60	15.323	3	5.108	.530	0.662 ^{n.s.}
	BWB90	41.044	3	13.681	1.768	0.152 ^{n.s.}

** - very significant ($P \leq 0.01$) * - significant ($P \leq 0.05$) n.s. - not significant ($P \geq 0.05$)

The results of fixed factors and its impact on body weights of lambs (table 3), showed very significant effect of genotype ($P < 0.01$) on body weights of lambs at birth (BWB), ages 30, 60 and 90 days (BW30, BW60, BW90). *Freking and Leymaster (2004)*; *Kuchtík et al., (2010)*; *Caro Petrović et al., (2012)*, reported a significant effect of genotype on growth traits of lambs are amenable with our results. An agreeable result also found by *El-Fadilli et al. (2000)*; *Margetín et al. (2004)*, who reported that the genotype significantly influenced the majority of growth traits. *Unal et al., (2006)*, had an opposite result with ours, they ratified in their study that lamb genotype had no significant effect on live weights of lambs at birth and 90 days of age. Another contrary result found by *Kuchtic and Dobes, (2006)* emphasizing that the evaluation of the effect of genotype on growth showed that this factor did not have a significant effect on the majority of growth traits. In the study of the following authors: *Burke et al. (2003)*; *Karaoglu et al. (2002)*; *Momani et al. (2010)*; *Fathala et al., (2014)*, they reported that growth performance (body weight) significantly differ among genotypes of sheep and that the desirable crossbreeding effects might be due to heterosis and breed complementarity. The recently statements rationalized the result of our study. Likewise, supporting our study was that with *Demeke et al., (2004)*, informing the effect of genotype was an important source of variation for body weight at all ages and that sex influenced bodyweight at birth.

In our study regarding effect of sex (table 3), was in complement with the result achieved by *Unal et al., (2006)*, that sex had highly significant effects ($P < 0.001$) on all ages. *Gökdal et al., (2004)* reported in their study that sex of lamb affected lamb weights at the various stages. The same authors commented that the effect of sex on live weight might be attributing to different physiological functions in the two sexes.

Regarding the interaction between genotype x sex (table 3), showed a very significant effect ($P \leq 0.01$) on body weight at birth (BWB) but were not significant ($P \geq 0.05$) on body weights of lambs at ages BW30, BW60 and BW90.

Conclusion

The study results showed highly significant effect of genotype on lambs' body weights at birth, at ages 30, 60 and 90 days. Male lambs of all genotypes showed better growth efficiency compared with females. There were highly significant effects of sex on all ages. Likewise obtained result showed that the interaction between genotype x sex showed a very significant effect on birth weight.

Based on the results as heavier lambs in both sexes of genotypes 4 showed superiority on growth traits at ages 30, 60 and 90 days, it served as an indicator that three-bred crossing resulted in high growth traits could be a showcase for farmers to realize the important role of system of crossing in sheep industry.

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Efekat genotipa, pola i njihovih interakcija na osobine porasta jagnjadi

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Rezime

Metode odgajivanja imaju važnu ulogu u ovčarskoj proizvodnji. Od suštinskog značaja u proizvodnji mesa ovaca je održavanje genetske raznovrsnosti i varijabilnosti populacija. Cilj ovih istraživanja je da se utvrdi uticaj genotipa i pola, kao i njihovih interakcija na osobine porasta jagnjadi. Rezultati studije pokazali su da muški pol svih genotipova je dominantan u pogledu mase tela u svim uzrastima (od BWB do BW90). Najveća telesna masa (BWB) bila je kod muških grla genotipa 2 (W). Najnižu telesnu masu na rođenju, imala su ženska jagnjad genotipa 1. Masa tela pri uzrastu od 30, 60 i 90 dana, kod oba pola je bila dominantna kod genotipa 4 (PxWxF). Genotip 1 (P)- oba pola, imao je najniže vrednosti masa u svim uzrastima (BWB, BW30, BW60, BW90). Rezultati istraživanja su pokazali bolju efikasnost rasta kod muških u odnosu sa ženska grla. Rezultati fiksnih faktora i njihovog uticaju na telesnu masu jagnjadi pokazali su veoma značajan efekat genotipa ($P < 0,01$) pri rođenju (BWB), kod uzrasta 30, 60 i 90 dana (BW30, BW60, BW90). Pol je imao visoko značajne efekte ($P < 0,001$) kod svih uzrasta. Interakcija između genotipa i pola pokazala je veoma značajan efekat ($P \leq 0.01$) na telesnu masu pri rođenju (BWB), ali dobijene vrednosti razlika nisu bile značajne ($P \geq 0.05$) u dobi BW30, BW60 i BW90. Superiornost genotipa 4 (PxWxF) pokazala se u uzrastu od 30, 60 i 90 dana, što može biti izazov i praktična korist za farmere koji koriste ukrštanje.

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