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GENETIC AND PHENOTYPIC ASPECTS OF THE BODY MEASURED TRAITS IN MERINOLANDSCHAF BREED OF SHEEP

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Abstract: Merinolandschaf sheep breed was used to estimate relationship between the next traits: Body weight of adult ewes (BW), Height to withers (HW), Body length (BL), Girth of Chest (GC), Rump Width (RW), Body weight of lambs at birth (BWB), Body weight of lambs at weaning (BWW). The collected data were from 750 sheep and their lambs during the period of three year. Estimates of means and standard errors for linear body measures and body weight of adult ewes and lambs, were obtained using the software program SPSS (2006). To estimate genetic and phenotypic correlations of observed traits, the ASREML program was used. Research has shown that genetic correlations between BW and all body measures of dams, ranging from 0.728 (BW-GC) to 0.976 (BW-HW). Genetic correlation between body measures of dams have also been positive and ranged in the interval from 0.873 (HW-GC) to 0.999 (BL-GC). Values for phenotypic correlations were lower compared with the genetic and the range varied from 0.183 (RW-BWB) to 0.421 (GC-BWW). The weaker phenotype correlations can be interpreted as play of more complex genetic and residual factors.

Key words: Genetic correlations, phenotypic correlations, body measures,sheep

Introduction

Testing and characterization of different breeds in the world is of particular interest for the future of sheep production *(Ugarte, 2007; Kurt And Horst, 2008)*. The production traits of sheep depend on a number of genetic and non-genetic factors *(Petrović et al., 2009)*. Farmers use different selection methods for improving the quality of their herds and select the best animals for further reproduction *(Safari et al., 2005)*. Growth usually defined as the increase in size or body weight at a given age, is one of the important selection criteria for improvement of lamb production *(Afolayan et al., 2006)*. Conventional methods of selection of sheep mainly take into account the fertility and quality of offspring given by a sheep or their ancestors. In other words, animals are usually estimated by what benefits they can give to farmers. At first glance this is quite normal, but not completely. Linear body measurements taken on live animals have been widely used in research work as a simple means of recording certain aspect of animal growth and shape *(Salako, 2006; Alphonsus et al., 2010)*. Linear measurement can be used in assessing growth rate, weight, feed utilization and carcass characteristic, for tracing relationship between production performance, visual appraisal and body measurements *(Lawrence and Fowler, 1998; Fourie et al., 2002)*. To determine optimal breeding strategies to increase the efficiency of sheep production, knowledge of genetic parameters for weight traits and also the genetic relationships between the traits in different breed of sheep is needed *(Neser et al., 2001; Jamssems and Vandepitte, 2004; Babar et al., 2008, Bahreini Behzadi et al., 2007; Komlosi, 2008; Gamasaee et al., 2010)*.

Merinolandschaf breed of sheep began to be increasingly imported from germany to serbia during the nineties. In addition to growing pure breed, it is also used for crossbreeding with local populations (*Petrović, 2000*). Among all the foreign breeds, it is the most represented breed of sheep in the country. It is used for the production of lamb meat, so that the body characteristics of sheep and lambs have special interest. There are no reports on genetic parameters for growth traits of Merinolandschaf breed of sheep.

The objective of this study was to estimate relationships between body development traits of Merinolandschaf sheep breed, or more precisely genetic and phenotypic correlation of linear body measurements of dams with their body weight and the body weight of their lambs.

Material and methods

The data used in the present study were collected during period of three years. A total of 750 controlled sheep after first, second and third lambing were included in the analysis. The animal observed were all Merinolandschaf sheep breed and was imported from Germany. The experiment included 200 lambs, after each lambing. The next traits of dams were considered: Body weight (BW), Height to withers (HW), Body length (BL), Girth of Chest (GC), Rump Width (RW). The following traits of lambs (from the observed dams) were considered: body weight at birth (BWB), body weight at weaning-3 months (BWW).

Body weight and linear measures of sheep were controlled after shearing each year in June. Lambs were weighed at birth and once a month until weaning at 3 months of age.

Height to withers (HW) was measured as the distance from the surface of a platform to the withers. Body length (BL) was measured at the distance from the external occipital protuberance to the base of the tail. Rump Width (RW) was measured as the distance between pinbones. Girth of Chest (GC) represented the circumference of the chest. The animals were weighed by sheep weighing balance (±100 gms). The body measurements were taken through the sheep measuring tools (±1cm).

Main source of feed during the spring-summer season was the natural pasture, without any additives. During the autumn-winter season, the sheep were fed hay, silage and concentrate. The quality of feeds varied every year of observation, but not significantly. Lambing season was from January to March, and lambs were kept with their mothers while in the special box received high-quality hay and a concentrate with 18% of protein.

Statistical analysis was performed using a fixed effect model ($Yijk = \mu + Gi + Sj + eijk$) where year and sex, was fitted using the GLM procedure of SPSS (2006). To estimate genetic and phenotypic correlations of observed traits, the ASREML program (Gilmour et al. (1999) was used.

Results and discussion

Estimates of means and standard errors for dams body measures and body weight of lambs given in Table 1. We can see in this table that the sheep has well expressed height, length and width, that is well built body frame. However the body weight of 54.64 ±0.22 kg is under the results in Germany (Seibert et al., 2004) where they were imported. This is due to extensive breeding conditions during spring-summer season. On the other side, body weight of lambs and gain is similar as in Germany. Also shown in same table, the effect of the year on all traits of body measures and body weight was very significant ($P<0.01$). We can also see that the effect of lamb sex was significant at a lower level ($P<0.05$).

Table 1. Means and standard errors for linear body measures and body weight of dams and lambs

Traits	N	Mean	SE	Effects	
				Year	Sex
BW	750	54.64	±0.22	**	
HW	750	73.22	±0.13	**	
BL	750	72.11	±0.17	**	
GC	750	97.66	±0.19	**	
RW	750	25.82	±0.07	**	
BWB	600	4.98	±0.03	**	*
BWW	580	27.16	±0.08	**	*

*-P<0.05; **-P<0.01

Table 2 (above diagonal) indicates strong positive genetic correlations between BW and all body measures of dams, ranging from 0.728 (BW-GC) to 0.976 (BW-HW). The correlation between body measures of dams have also been very positive and ranged in the interval from 0.873 (HW-GC) to 0.999 (BL-GC). Similar to our research, *Moktar and Farhad et al. (2011)* stated that genetic correlations between traits of body weight and body measurements in Makooei sheep were positive and ranged from low to high (0.15-0.99), which indicated that traits were genetically linked.

Borg et al. (2009) in a herd of Targhee breed of sheep found strong genetic correlations between BW and BCS (body condition score), respectively, reflecting high repeatabilities of these traits. In the other literature can too find that genetic correlations of the body measures in sheep are positive (*Duguma et al., 2002 and Salako, 2006b)*. From Table 2 (below diagonal), we can see results for phenotypic correlation between observed traits of sheep. Results of phenotypic correlations varied from weak to medium. The values of correlations between BW and all linear body measures ranging from 0.235 to 0.591. Phenotypic correlation between linear body measures of dams varied in the range from 0.302 (RW-BL) to 0.613 (GC-BL). It is evident that the values of phenotypic correlations are less than genetic. Similar results found out by *Bahreini Behzadi et al. (2007*), stated that phenotypic correlations between various stages of body development in Kermani sheep were positive and generally less than corresponding genetic correlations.

Table 2. Estimates of genetic correlations (above diagonal) and phenotypic correlations (below diagonal) between linear body measures of dams

Traits	BW	HW	BL	GC	RW
BW	-	0.976**	0.785**	0.728**	0.730**
HW	0.591**	-	0.914**	0.873**	0.875**
BL	0.422*	0.432*	-	0.999**	0.989**
GC	0.484*	0.467*	0.613**	-	0.998**
RW	0.235 n.s.	0.307 n.s.	0.302 n.s.	0.392*	-

n.s. Correlation was not significant, **Correlation is significant at the 0.01 level, *Correlation is significant at the 0.05 level

Gamasaee et al. (2010) found that phenotypic correlation estimates in Mehraban sheep were generally lower than those of genetic correlation. *Afolayan et al. (2006)* stated that variables such as height, length, girth, which are directly related to the size and weight of Yankasa sheep, displayed moderate to very high positive correlations with one another (0.79–0.87). In our study, we paid special attention to the connection between body measures of dams and body weight of lambs, because it is a very interesting parameter for the practical breeding of sheep (Table 3).

Table 3. Estimates of genetic correlations between linear body measures of dams and body weight of lambs

Traits of dam	Traits of lambs	
	BWB	BWW
BW	0.986**	0.899**
HW	0.992**	0.987**
HL	0.945**	0.993**
GC	0.906**	0.969**
RW	0.907**	0.974**

**Correlation is significant at the 0.01 level

There is an evident of strong genetic correlation between the body weight of sheep and lambs body weight at birth (0.986-BWB) and at weaning (0.899-BWW). It also shows that there is a strong positive genetic correlation (over the value of 0.900) between all linear measures of sheep and lambs body weight on investigated age. Our findings agree or slightly higher in comparison with other authors. *Hussain et al. (2000)* found that the weight of dams had a positive correlation with body weight of lambs at birth. *Matika et al.(2001),* in a flock of Sabi Sheep discovered that the genetic correlation between birth weight and ewe weights (mating, post-partum and dam weight at weaning of lamb) were moderate viz. 0.51, 0.40 0.49 respectively and were close to unity at 18 months of age viz. 0.96, 0.92 ,0.84 respectively. There is a positive genetic correlation between body weight of sheep and lambs and are confirmed with the studies of *Mousa et al. (1999)*. There were high additive genetic correlations between muscle mass and type of land sheep breeds in Germany *(De Vries et al., 2003).*

The values of phenotypic correlation (table 4) between measures of dams and body weight of lambs are less in comparison with genetic correlations. Variations areal of phenotypic correlation were from 0.183 (RW-BWB) to 0.421 (GC-BWW). The weaker phenotype correlations can be interpreted as play of more complex genetic and residual factors. *Everett-Hincks and Dodds (2008)* reported the importance of environmental effects of mother body condition score on weaning lamb weight traits and showed a weak positive phenotypic correlation (rp=0.09). *Bahreini Behzadi (2007)* stated that phenotypic correlations between various stages of body development in Kermani sheep were generally less than corresponding genetic correlations.

Table 4. Estimates of phenotypic correlations between body measures of dams and body weight of lambs

Traits of dam	Traits of lambs	
	BWB	BWW
BW	0.258 n.s.	0.368*
HW	0.187 n.s.	0.254 n.s.
HL	0.207 n.s.	0.287 n.s.
GC	0.250 n.s.	0.421*
RW	0.183 n.s.	0.205 n.s.

n.s. Correlation was not significant, *Correlation is significant at the 0.05 level

Conclusions

Our research has shown that there is a positive relationship between all investigated body measures of sheep. There is a high genetic correlation between linear body measures of dams and body weight of lambs at birth and weaning. The genetic correlation is strongly expressed between measures of body weight of mothers and their lambs at birth, while the body weight of lambs at weaning had a greater impact of environmental factors and other non-genetic parameters. Relationships between observed traits in this study indicate that selection for greater body measures can increase body weight of sheep and lambs. Phenotypic correlations were less than genetic, which is consistent with cited authors.

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Genetički i fenotipski aspekti osobina telesnih mera Merinolandschaf rase ovaca

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Rezime

Merinolandschaf ovce su korišćene za procenu odnosa između sledećih osobina: Telesna masa odraslih ovaca (BW), visina grebena (HW), dužina tela (BL), obim grudi (GC), širina karlice (RW), telesna masa jagnjadi na rođenju (BWB) Telesna masa jagnjadi pri odlucivanju (BWW). Prikupljeni podaci potiču od 750 ovaca i njihove jagnjadi tokom perioda od tri godine. Procene sredina i standardnih grešaka za linearne telesne mere i telesne mase odraslih ovaca i jagnjadi, genetske i fenotipske korelacije, dobijeni su korišćenjem softvera SPSS (2006). Istraživanja su pokazala da genetske korelacije između BW i svim ostalim telesnim merama variraju, u rasponu od 0.728 (BW-GC) do 0.976 (BW-HW). Genetski korelacija između telesnih mera varirale su u pozitivnom opsegu od 0.873

(HW-GC) do 0.999 (BL-GC). Vrednosti fenotipskih korelacija bile su niže u poređenju sa genetskim u intervalu variranja od 0.183 (RW-BWB) do 0.421 (GC-BWW). Slabije fenotipske korelacije možemo tumačiti kao igru složenijih genetskih faktora i nedeterminisanih efekata.

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