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*Full Length Research Paper*

# Influence of environmental factors on birth weight variability of indigenous Serbian breeds of sheep

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**The present investigation was carried out to study the influence of environmental factors on the birth weight variability of two breeds of sheep. Animals used in this research were taken from the Pirot and Svrljig indigenous sheep breeds. The data were collected from 1999 to 2009 and were analyzed to determine the effect of the year and season, age of the lamb, weight of the lamb, birth type and sex on the birth weight of lambs. Both sheep breeds were managed in the same farm and under the same farm conditions. Statistical analysis was performed by using GLM procedure of SAS statistical package program. Results showed that young (2 to 3 years) and old (6 to 7 years) mothers gave birth to lighter lambs, while sheep in the middle age (4 to 5 years) gave birth to lambs with the heaviest body weight. However, the differences were respectively significant ($P < 0.01$). Birth weight of lambs also depended on weight of lamb, although differences in the average body weight of lambs were statistically significant ($P < 0.05$). Type of birth also had effect on the body weight of lambs at birth in both Pirot and Svrljig breeds ($P < 0.05$). Body weight of lambs at birth were almost the same for both sexes (3.39 and 3.36 kg for male and female in Pirot breed and 3.48 and 3.43 kg for male and female in Svrljig breed, respectively), though the difference was not statistically significant ($P > 0.05$). The values of birth weight observed for quite a number of years ranged from 3.27 to 3.52 kg in Pirot and 3.34 to 3.51 kg in Svrljig breed ($P < 0.01$). Lambs born in the spring-summer season has the heaviest body weight at birth. Conversely, the significant difference ($P < 0.05$) can only be interpreted as the factor of food source.**

**Key words:** Environmental factors, birth weight variability, indigenous sheep.

## INTRODUCTION

Body weight of lambs at birth has an important role in achieving a good sheep production. In recent years, genetic improvement program for sheep in Serbia have been primarily directed towards the improvement of growth and carcass traits. Productivity of sheep is affected by many factors, such as breed improvement programs based on the maximum utilization of genetic variation, but these features may also vary due to certain environmental factors. Information on the relative performance of indigenous sheep breeds in Serbia is not always available or may vary from year to year. It is therefore important to investigate the effects of various factors on the variation among animals in order to find efficient breeding plans to improve production. There are a number of well-known influences that significantly affect fetal growth and birth weight of lambs (Robinson et al., 1977; Black, 1983). Due to the understanding of the role of body weight at birth, the study came to a realization that this feature affects a large number of factors, including year and season of birth, age of lamb, birth type and sex of lamb (Sormunen and Suvela, 1999; Hansen and Shrestha, 2002; Fisher, 2004; Rosa and Bryant, 2003; Barbar et al., 2004; Notter et al., 2005; Susic et al., 2005). With regard to maternal nutrition influencing birth weight in the sheep, much information is available, but occasional discrepancies arise, most likely due to differences between breeds of sheep and sample size (Russel, 1971; Russel and Foot, 1973; Robinson, 1977; Mellor and Matheson, 1979; Wallace et al., 1996; Heasman et al., 2000). In addition to the number of lambs which is obtained by sheep, body weight of lambs at birth plays an important role as an initial power factor for the later development of the young organism (Petrovic, 2007;

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**Table 1.** Effect of age of dam, weight, birth type and sex on birth weight of lambs.

| Effect | | Breed of sheep | | | | | |
|---|---|---|---|---|---|---|---|
| | | Pirot | | | Svrljig | | |
| | | Number of record | $\bar{X}$ | ±SE | Number of record | $\bar{X}$ | ±SE |
| | | | ** | | | ** | |
| Age of dam | Young | 1970 | 3.19 | 0.10 | 1822 | 3.23 | 0.11 |
| | Mature | 3078 | 3.44 | 0.08 | 3121 | 3.52 | 0.09 |
| | Old | 1120 | 3.35 | 0.11 | 1232 | 3.39 | 0.10 |
| | | | * | | | * | |
| Weight of lamb | Lightest | 3020 | 3.33 | 0.11 | 3109 | 3.37 | 0.10 |
| | Heaviest | 3103 | 3.41 | 0.09 | 3061 | 3.50 | 0.08 |
| | | | * | | | * | |
| Birth type | Single | 4931 | 3.48 | 0.11 | 4897 | 3.53 | 0.09 |
| | Multiple | 1189 | 3.27 | 0.12 | 1211 | 3.36 | 0.12 |
| | | | NS | | | NS | |
| Sex of lamb | Male | 3071 | 3.39 | 0.10 | 2916 | 3.48 | 0.11 |
| | Female | 2998 | 3.36 | 0.13 | 3111 | 3.43 | 0.15 |

NS, Not significant (P > 0.05); *, significant (P < 0.05); **, significant at (P < 0.01).

Petrovic et al., 2008; Riggio et al., 2008). Body weight at birth also affect the vitality and mortality of lambs during development (Morris et al., 2000; Cloete et al., 2001; Zapasnikiene, 2002; Berhane and Arendonk, 2006; Vatankhah and Taleb, 2009). However, Gardner et al. (2007) stated that knowledge of factors affecting variation in birth weight is especially important, given the relationship of birth weight to neonatal and adult health. They concluded that the results of their study have practical implications not only for sheep husbandry, but also for the increased knowledge of factors that significantly influence variation in birth weight; as birth weight itself has become a significant predictor of later health outcomes. In view of these findings in recent years, the weight of lambs at birth in science and practice has been given much more importance than ever.

The objective of this study was to estimate the environmental factors affecting birth weight variability in two indigenous Serbian breeds of sheep.

## MATERIALS AND METHODS

The data maintained at the Stara planina region of Serbia during 1999 to 2009 were obtained for this study. Animals included in this research were taken from the Pirot and Svrljig indigenous breeds of sheep and were managed under the same farm conditions. From November to May, the flock was at the farm and was fed with hay and concentrate. During the rest part of the year, the sheep were grazed on mountain natural pastures. The data were analyzed to estimate the effect of year and season, age of the lamb, weight of lamb, birth type and sex on the birth weight of lambs. The lambs were grouped into three age groups on the basis of their age at lambing: young (2 to 3 years), mature (4 to 5 years) and old (6 to 7 years), and two groups regarding their weight: lightest (50 to 55 kg) and heaviest (56 to 60 kg). Statistical analysis was performed by the GLM procedure of SAS statistical package program (SAS, 2005) using the next model:

$$Yijklmno = \mu + Ji + Sj + Ak + Wl + Tm + Ln + \varepsilon ijklmno,$$

Where, Yijklmno is the birth weight of oth lamb; nth is the sex; mth is the birth type; lth is the weight of lamb; kth is the age of lamb and period of birth during jth season in ith year; μ is the overall population mean; Ji is the effect of ith year; Sj is the effect of jth season; Ak is the effect of kth age of the lamb; Wl is the effect of lth weight of the lamb; Tm is the effect of mth type of birth; Ln is the effect of sex of lamb and εijklmno is the residual error.

## RESULTS AND DISCUSSION

Table 1 shows the effect of the age of dam, weight of lamb, birth type and sex of lamb on birth weight of lambs. Variations of body weight in lambs depended on the mother's age range in the interval from 3.19 to 3.44 kg in Pirot lambs and 3.23 to 3.52 kg in Svrljig lambs. It was observed that young and old mothers gave birth to lighter lambs, while sheep in middle ages (mature lamb) gave birth to heavier lambs. Consequently, the differences were significant, respectively (P < 0.01). Likewise, birth weights of lambs depended on the weight of dam. As shown in Table 1, lambs in both breeds are heavy if their mothers are heavy (3.41 kg for Pirot and 3.50 kg for Svrljig), while they are light if their mothers are light (3.33

**Table 2.** Effect of year and season on birth weight of lambs.

| Effect | Breed of sheep | | | | | |
|---|---|---|---|---|---|---|
| | Pirot | | | Svrljig | | |
| | Number of record | $\bar{X}$ | ±SE | Number of record | $\bar{X}$ | ±SE |
| **Year** | | ** | | | ** | |
| 1 | 553 | 3.42 | 0.12 | 611 | 3.36 | 0.10 |
| 2 | 590 | 3.27 | 0,13 | 690 | 3.48 | 0,09 |
| 3 | 589 | 3.44 | 0.09 | 609 | 3.38 | 0.13 |
| 4 | 602 | 3.38 | 0.08 | 691 | 3.50 | 0.16 |
| 5 | 634 | 3.31 | 0.15 | 600 | 3.34 | 0.15 |
| 6 | 597 | 3.51 | 0.16 | 620 | 3.42 | 0.14 |
| 7 | 688 | 3.30 | 0.11 | 599 | 3.47 | 0.12 |
| 8 | 612 | 3.40 | 0.10 | 585 | 3.51 | 0.09 |
| 9 | 616 | 3.52 | 0.12 | 593 | 3.38 | 0.13 |
| 10 | 697 | 3.36 | 0.09 | 547 | 3.49 | 0.11 |
| Total | 6178 | 3.38 | 0.11 | 6145 | 3.43 | 0.12 |
| **Season** | | * | | | * | |
| Autumn-winter | 3710 | 3.33 | 0.11 | 3650 | 3.37 | 0.13 |
| Spring-summer | 2460 | 3.41 | 0.14 | 2478 | 3.45 | 0.12 |

NS, Not significant (P > 0.05); *, significant (P < 0.05); **, significant at (P < 0.01).

kg for Pirot and 3.37 kg for Svrljig). As such, the effect of the weight of dam in both breeds was statistically significant (P < 0.05).

Type of birth also has an effect on the body weight of lambs at birth in both Pirot and Svrljig breeds. The variations in birth weight range from 3.27 (twins) to 3.48 kg (single) in Pirot breed and 3.36 (twins) to 3.53 kg (single) in Svrljig breed, respectively. Significance test shows that existing differences in the average body weight of lambs were statistically significant (P<0.05). Gamasaee et al. (2010) also stated that the effect of birth type was significant on birth weight of lambs and can be explained by limited uterine space and nutrition of lamb during pregnancy.

In Table 1, it can be seen that average body weight at birth on both sexes of lambs was almost the same (3.39 and 3.36 kg for male and female in Pirot breed, and 3.48 and 3.43 kg for male and female in Svrljig breed, respectively). Existing differences in birth weight between male and female lambs in both breeds were not statistically significant (P > 0.05).

Baneh and Hafezian (2009) reported that, interactions between lamb's sex, age and birth type significantly affected the weight of birth. Other researchers (Notter et al., 1991) have also reported that birth weight of lambs was influenced by lamb sex and ewe x season interaction. Dixit et al. (2001) found that the effect of sex, birth type and lamb's age was statistically significant on the weight of lambs. This result is in accordance with the results of this study.

Results of the influence of year and season on the body weight of lambs at birth are shown in Table 2. The values of birth weight observed for quite a number of years ranged from 3.27 to 3.52 kg in Pirot breed and from 3.34 to 3.51 kg in Svrljig breed, and the differences between years were statistically significant (P<0.01). The results of this study are similar to the results of Gardner et al. (2007), which stated that there was a significant effect of the year's influence on average birth weight of lambs.

Depending on the season of lambing, it can be seen (Table 2) that lambs born in the spring-summer season have the heaviest body weight at birth (3.41 kg for Pirot breed and 3.45 kg for Svrljig breed) in comparison with lambs born in the autumn-winter season (3.33 kg for Pirot breed and 3.37 kg for Svrljig breed). The significant difference of body weight at birth between the two seasons (P<0.05) can be interpreted as the influence of feeding and surroundings. In Serbia, during the spring-summer season, the quality of food and feeding is better. The pasture grass and pleasant surroundings have positive effect on animals, especially during the last two months of pregnancy. During the autumn-winter the sheep fed to indoor feeding, when amount and quality of food and surroundings is inferior.

Influence of lambing during various seasons on sheep production has been studied by several authors (Demiroren et al., 1995; Sormunen and Suvela, 1999; Hansen and Shrestha, 2002; Fisher, 2004; Rosa and Bryant, 2003). In the majority of cases, the results have

shown that season has a significant influence on important economic features. The mentioned factors can be connected with vegetation growth (as a food source), temperature and day length, all of which depend on seasonal and climate characteristics specific for different geographic regions. Lambs born in different seasons of the year tend to have different birth weights. Dixit et al. (2001) stated that the effect of year and season is statistically significant on the weight of the lambs. Mendel et al. (1989) stated that the lambs of Würtemberg breed (Merinolandschaf), born in spring (mean birth weight of 3.9 kg) and summer (mean birth weight of 3.9 kg), are heavier than those born in autumn (mean birth weight of 3.8 kg) and winter (mean birth weight of 3.7 kg).

## Conclusion

This study showed that environmental factors have an important impact on production in sheep. The best results observed in both indigenous breeds of sheep can be achieved in the lambing season spring-summer and if the mother's middle-aged and if dam have higher body weight. Type of birth also has an impact on the body weight of lambs. In practice lower birth weight of twins are expected, but it can get a large number of lambs. Sex of lambs show no significant influence on body weight at birth. If known that weight at birth has an influence on body development and mortality of lambs and overall effect of production, then in the sheep breeding programs must make bigger attention on environment.

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