

THE INFLUENCE OF SOME FACTORS ON THE PRODUCTION EFFECTS OF SJENICA SHEEP

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Abstract: Gene expression at the phenotypic level varies due to a number of influences from the environment in which the animals are reared. Ignoring this reality or due to insufficient knowledge, farmers are often disappointed when choosing a population of sheep when they do not get the production results that the breed achieves where they bought it. The investigation of the reproductive and production characteristics of parent herds of Sjenica sheep was conducted on four farms. In the research, it included a total of 921 lambs and 474 sheep. The influence of sheep body weight on the weight of lambs at birth within a farm was analyzed. Based on the research conducted on the sheep population and after the obtained and processed data, we can state the following: certain differences were found in the fertility of sheep depending on the farm and body weight. We also perceived that certain differences in the body weight of the lambs are evident depending on the weight group of the sheep and the farm where the sheep were raised. All of the above leads us to the general conclusion that management is extremely important in sheep farming. If the selection of the breeding population is carried out correctly and adequate measures of keeping, nutrition and reproduction are applied, success is guaranteed.

Key words: sheep, fertility, body weight, farm, production effect

Introduction

As is known in the theory of domestic animal genetics (*Petrović et al., 2015*), gene expression at the phenotypic level varies from a number of genetic factors and the influence of the environment in which the animals are reared. *Gardner et al. (2007)* said that the maternal effect on composition of the body prior to pregnancy and nutrition during gestation also had significant effects on birth weight in the sheep. The efficiency of sheep production is conditioned by fertility. According to some authors, the number of offspring obtained per lambing

is more important than the gain of weight (*Petrović et al., 2012*). The frequently used indicators of sheep reproductive performance include fertility (*Vlahek et al., 2023*). Reproductive performance in animal husbandry is a very important trait that affects profitability. Ewe live weights, nutrition, weather, and season have all reportedly influenced reproductive performance (*Gaskins et al., 2005; Akhtar et al., 2012; Aktaş et al., 2015; Behrem et al., 2022*). The evaluation of the genetic potential of sheep in Serbia can be found in the papers (*Petrović et al., 2009; 2015*). Not having this reality in mind or due to insufficient knowledge, farmers are often disappointed when choosing a population of sheep because they do not get the production results that the breed achieves when they buy it. With this in mind, many authors are studying various factors affecting sheep production (*Askoy et al., 2023*). The Sjenica sheep, as a member of the widespread autochthonous breed that we call Pramenka, plays an important role in Serbian sheep farming, especially in its western and south-western regions. This sheep is also the most numerous population of Pramenka. Because of all this, it is of particular importance to study various factors that contribute in any way to its profitability of breeding. The aim of this paper is to find further contributory factors to this necessity based on prior study (*Lecić et al., 2022*).

Material and Methods

The study of the reproductive and production characteristics of the parent flocks of Sjenica sheep was conducted on four private farms in the area of Kolubar district. It included in the research 474 adult sheep that lambed in the years 2017 and 2018, consisting of 921 total lambs in the four farms.

The determination of the effect of adult sheep body weight on fertility in the years 2017 and 2018 within farms as well as the impact of sheep adult weight on lambs' birth weight, the rest method and the statistical analysis was the same with (*Lecić et al., 2022*).

Throughout the research, the influence of sheep body weight on the weight of lambs at birth within the farm was examined. The statistical analysis of the accessed experimental data was done using the software statistical package Statistics for Window 7 (Stat. Soft. Inc.). The equality of variances of the analysed treatments was also tested using Levene's test.

The impact of body weight of sheep on the fertility and the weight of lambs at birth within the farms was scrutinized using the variance analysis method (one-factor analysis). The differences between the mean values of the investigated treatments were analysed using Fisher's LSD test, T-test, and HSD test. Analyses were performed at a significant level of 0.05 and 0.01, and the obtained results are presented as means \pm standard deviation ($X \pm SD$).

Results and Discussion

The influence of sheep's body weight on fertility within farms in 2017 and 2018 is seen in tables 1 and 2.

Table 1. Effect of sheep body weight on fertility in 2017 within observed farms

Farm of sheep	Weigh group of sheep, kg	N	Fertility		
			\bar{X}	SD	CV
Farm 1	60-65	39	1.90	0.82	43.16
	66-70	20	1.95	0.94	48.21
Farm 2	60-65	23	1.78	0.85	47.75
	66-70	25	1.84	0.94	51.09
	71-75	3	1.00	0.00	0
Farm 3	70-75	14	2.71	0.99	36.53
	76-80	25	2.68	0.95	35.45
	81-85	12	2.42	0.90	37.19
Farm 4**	60-65	8	1.75 ^b	0.71	40.57
	66-70	30	2.27 ^b	1.01	44.49
	71-75	18	2.17 ^b	1.15	53.00
	76-80	3	4.33 ^a	2.31	53.35

**P<0.01

a, b - statistically significantly different at the 0.01 level

As can be viewed from the results shown in Table 1, the influence of weight groups of sheep on fertility was highly significant only within farm 4 (P<0.01). Looking in particular at farms 1 and 2, natural mating is applied. It can be noted that the body weight of sheep from farms 1 and 2 has a significantly higher fertility than the one reported in the literature for the Sjenica sheep, which is 1.20. This difference is due to a more intensive breeding method and the application of estrus induction with hormones in some sheep under our research.

On these two farms, two rams are kept constantly with ewes so that some ewes gave birth at the beginning of 2017 (more precisely, in February 2017) and that are well prepared were fertilized in June of this year and lambed again in November of the same year. For this reason, the fertility of the sheep in the table (1) is significantly different from the one mentioned in the literature, because at these two farms, out of the total number of 10 sheep, they gave birth for the second time in the same year, so that we got 4 lambs from some sheep in that year.

Estrus synchronization is applied on farms 3 and 4. A certain number of sheep from farms 3 and 4 also gave birth at the beginning and end of the year.

Table 2. Effect of sheep body weight on fertility in 2018 within observed farms

Farm of sheep	Weigh group of sheep, kg	N	Fertility		
			\bar{X}	SD	CV
Farm 1	60-65	18	1.39	0.61	43.88
	66-70	40	1.68	0.76	45.24
	71-75	11	2.00	0.63	31.50
Farm 2	60-65	30	1.90	0.84	44.21
	66-70	30	2.16	0.83	38.43
	71-75	2	2.00	1.41	70.50
Farm 3*	65-70	16	1.63 ^A	0.50	30.67
	71-75	15	1.47 ^{AB}	0.63	42.86
	76-80	27	1.19 ^B	0.40	33.61
	81-85	14	1.21 ^{AB}	0.43	35.53
Farm 4	60-65	8	2.25	1.04	46.22
	66-70	27	1.96	0.94	47.96
	71-75	16	2.31	1.20	51.95

*(P<0.05)

A,B, - statistically significantly different at the 0.05 level

As can be spotted from the results shown in table 2, the influence of weight groups of sheep on fertility was highly significant only within farm 3 (P<0.05). The fertility of sheep in 2018 per farm was lower compared to the fertility in 2017. The reason is that in 2018, sheep lambled only once during the year, unlike in 2017, where we had a certain number of sheep on farms that lambled twice. Three weight groups of sheep were recorded on farms 1, 2 and 4, and four weight groups of sheep were recorded on farm 3. Sheep with a body weight of 71-75 kg from farm 4 had the highest fertility out of 2.31. Sheep with a body weight of 76-80 kg from farm 3 had the lowest fertility of 1.19.

Alafar et al. (2022) state that the reproductive performance of sheep varies by genetic factors, but sheep's reproductive performance is significantly affected by non-genetic factors, which should be included in genetic analysis and taken into account for improving sheep herd breeding. *Amnate et al. (2016)* said some factors affecting fertility showed a highly significant difference (P< 0.01) in the weight of the mother from the insemination to the fertility. These authors' notes justify the results we obtained.

The impact of sheep body weight on the birth weight of lambs in 2017 and 2018 are presented in tables 3 and 4.

Table 3. The influence of body weight of sheep on lambs' birth weight in 2017

Farm of sheep	Weigh group of sheep, kg	N	Body weight of lambs at birth, kg				
			\bar{X}	SD	CV	Min	Max
Farm 1	60-65	73	3.52	0.56	15.91	2.30	4.60
	66-70	39	3.32	0.47	14.16	2.40	4.40
Farm 2*	60-65	42	3.31 ^B	0.56	16.92	2.20	4.70
	66-70	46	3.30 ^B	0.65	19.70	2.10	4.60
	71-75	3	4.20 ^A	0.0	0	4.20	4.20
Farm 3	70-75	38	4.04	0.59	14.60	2.80	5.50
	76-80	65	4.11	0.64	15.57	2.70	5.50
	81-85	30	3.94	0.62	15.74	2.70	4.90
Farm 4**	60-65	14	4.05 ^{ab}	0.66	16.30	2.90	5.40
	66-70	69	3.80 ^b	0.68	17.89	2.40	5.20
	71-75	39	3.56 ^{bc}	0.73	20.51	2.70	5.40
	76-80	14	3.04 ^c	0.85	27.96	2.20	5.20

*(P<0.05) **P<0.01

A,B, - statistically significantly different at the 0.05 level

a, b, c - statistically significantly different at the 0.01 level

As noticed in table 3, the influence of sheep body weights on lambs' body weight at birth was significant in farm 2 (P<0.05) and farm 4 (P<0.01). The highest average body weight at birth was 4.20 kg, achieved by sheep lambs from farm 2 with a body weight of 71-75 kg. The least average lambs' weight at birth was 3.04 kg attained by sheep lambs from farm 4 with a body weight of 76-80 kg.

Table 4. The influence of body weight of sheep on lambs' birth weight in 2018

Farm of sheep	Weigh group of sheep, kg	N	Body weight of lambs at birth, kg				
			\bar{X}	SD	CV	Min	Max
Farm 1	60-65	26	3.88	0.59	15.21	2.80	5.10
	66-70	70	3.80	0.64	16.84	2.80	5.40
	71-75	22	3.93	0.73	18.58	2.90	5.40
Farm 2	60-65	56	3.42	0.59	17.25	2.50	4.60
	66-70	66	3.36	0.63	18.75	2.50	4.50
	71-75	4	3.63	0.90	24.79	2.70	4.40
Farm 3**	65-70	23	3.77 ^b	0.78	20.69	2.90	4.40
	71-75	26	3.48 ^b	0.43	12.36	2.50	5.10
	76-80	30	4.41 ^a	0.56	12.70	3.10	5.50
	81-85	17	4.30 ^a	0.62	14.42	3.20	4.80
Farm 4	60-65	19	3.74	0.56	14.97	2.90	4.50
	66-70	52	3.55	0.60	16.90	2.30	4.90
	71-75	37	3.77	0.69	18.30	2.80	5.20

**P<0.01

a, b - Means significantly different at the 0.01 level

As recognized in table 4, the influence of maternal body weight on the lambs' body weight at birth was significant only within farm 3 ($P < 0.01$). The highest average body weight at birth was achieved by sheep lambs from farm 3, with a body weight of 76-80 kg from 4.41 kg. The lowest average body weight of lambs at birth was recorded in sheep on farm 2, with a body weight of 66-70 kg from 3.36. Differences in body weight of lambs at birth in relation to weight groups of sheep did not vary statistically significantly within farms 1, 2, and 4.

The study of *Petrović et al. (2015)* observed that lambs in both genotypes, Pirot x Württemberg and Sjenica x Württemberg, were heavier at birth if born from heavier ewes, the later statement partly defend our results. *Aktaş et al. (2015)* investigated the effects of ewe's live weight and age on reproductive performance and lamb growth. Several other authors have tested the effects of environmental factors on the production performance of sheep (*Aliyari et al., 2012; Fraga et al., 2018; Bancheva et al., 2022; Campos et al., 2022*). Besides all of these, *Van Der et al. (2010)* concluded that dam weight had no effect or only minor effect on reproductive performance of the offspring.

It is not directly concerned with our results but possibly correlates with the results of our study, *Fraga et al. (2018)* and *Campos et al. (2022)* that inadequate nutrition of the ewe, especially in the last third of gestation, is associated with a reduction in lamb birth weight and development. The reproductive performance of sheep conceived, born, and reared under different degrees of nutritional adversity provided evidence that inadequate or inappropriate fetal and/or early postnatal nutrition reduces adult reproductive performance (*Gunn et al., 1995; Purushotam Joshi, 2022*). In the study of *Corner-Thomas et al. (2015)*, it appears that poor reproductive performance of ewe lambs with a BCS of 2.0 or less was independent of the ewe lamb's live weight, then if ewe lambs have a body condition score of greater than 2.0, differences in fertility and reproductive rate appear to be explained by differences in live weight.

Conclusion

Based on the conducted research on the Sjenica sheep population and after the obtained and processed data, we can state the following.

Certain differences have been found in sheep fertility depending on the farm and body weight. We can notice that some differences are evident in lambs' weight at birth depending on the sheep's weight group and the farm where the sheep were raised. All of the above leads us to the general conclusion that management is highly essential in sheep farming. If we make a proper selection of the breeding population and apply adequate measures of keeping, nutrition, and reproduction, success is guaranteed. The results of our research confirm that this is not always the case on all farms.

Uticaj nekih faktora na proizvodne efekte sjeničke ovce

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Rezime

Ekspresija gena na fenotipskom nivou varira zbog brojnih uticaja iz sredine u kojoj se životinje uzgajaju. Ignorišući ovu realnost ili zbog nedovoljnog znanja, farmeri su često razočarani, pri izboru populacije ovaca jer ne dobijaju proizvodne rezultate koje rasa postiže tamo gde su je otkupili. Ispitivanje reproduktivnih i proizvodnih karakteristika matičnih stada sjeničkih ovaca obavljeno je na četiri farme. Istraživanjem je obuhvaćeno ukupno 921 jagnje i 474 ovce. Tokom istraživanja analiziran je uticaj telesne mase ovaca na težinu prirodnih jagnjadi u okviru farme. Na osnovu istraživanja sprovedenog u posmatranoj populaciji ovaca i nakon dobijenih i obrađenih podataka, možemo konstatovati sledeće: utvrđene su određene razlike u plodnosti ovaca u zavisnosti od farme i telesne mase. Takođe vidimo da su evidentne određene razlike u telesnoj masi jagnjadi u zavisnosti od težinske grupe ovaca i farme na kojoj su ovce uzgajane. Sve navedeno nas dovodi do opšteg zaključka da je menadžment izuzetno važan u ovčarstvu. Ako se pravilno izvrši selekcija priplodne populacije i primenjuju adekvatne mere držanja, ishrane i reprodukcije, uspeh je zagarantovan.

Ključne reči: ovce, plodnost, telesna težina, farma, proizvodni efekat

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References

- AKHTAR M., JAVED K., ABDULLAH M., AHMAD N., ELZO M. A. (2012): Environmental factors affecting preweaning growth traits of Buchi sheep in Pakistan. *Journal of Animal and Plant Sciences*, 22, 529-536.
- AKSOY Y., ŞEKEROĞLU A., DUMAN M., ÇOBAN ÖNDER B. (2023): A study on the Determination of Some Reproductive Traits of Ewes and The Growth Performance of Lambs Akkaraman Raised under Farm Conditions in the Province of Niğde. *Turkish Journal of Agriculture - Food Science and Technology*, 11, 6, 1168–1175. <https://doi.org/10.24925/turjaf.v11i6.1168-1175.5991> .
- AKTAŞ A. H., DURSUN Ş., DOĞAN Ş., KIYMA Z., DEMIRCI U., HALICI İ. (2015): Effects of ewe live weight and age on reproductive performance, lamb

- growth, and survival in Central Anatolian Merino sheep. *Archives Animal Breeding*, 58, 451–459. <https://doi.org/10.5194/aab-58-451-2015>, 2015.
- ALIYARI D., MOEINI M.M., SHAHIR M.H., SIRJANI M.A. (2012): Effect of Body Condition Score, Live Weight and Age on Reproductive Performance of Afshari Ewes. *Asian Journal of Animal and Veterinary Advances*, 7, 904-909. doi:10.3923/ajava.2012.904.909.
- AMNATE A.A., MOHAMMED Q.S., MAHDI Z.M., MAHDI A.J., JAFFAR H.M., SAMMEN M.M., HAMD R.A. (2016): A study of some factors affecting fertility, fecundity and twinning rate in local and Cyprus goats. *Al-Anbar Journal of Veterinary Sciences*, 9, 2, 94-99.
- BANCHEVA T., STOYCHEVA S., DIMITROVA T., MARKOV N., MONDESHKA L., HRISTOV M. (2022): Impact of various factors on live birth weight lambs – review. *Scientific Papers. Series D. Animal Science*, LXV, 1, 259-266.
- BEHREM S., TUNCER S. S., ŞENYÜZ H. H. (2022): Comparison of reproductive performance, live weight, survivability, and fleece characteristics of indoor-raised Central Anatolian Merino and Malya sheep. *Revista Brasileira de Zootecnia*, 51, e20210036. <https://doi.org/10.37496/rbz5120210036>.
- CAMPOS N. R. F., DIFANTE G. S., GURGEL A. L. C., COSTA C. M., MONTAGNER D. B., EMERENCIANO NETO J. V., ÍTAVO L. C. V., ÍTAVO C. C. B. F., CARVALHO NETTO R. T., VÉRAS E. L. L., COSTA A. B. G. (2022): Effect of supplementation of ewes in the final third of gestation on the development of their lambs. *Revista Brasileira de Zootecnia*, 51, e20210094. <https://doi.org/10.37496/rbz5120210094>
- FRAGA F. J. R., LAGISZ M., NAKAGAWA S., LOPEZ-VILLALOBOS N. BLAIR H. T., KENYON P. R. (2018): Meta-analysis of lamb birth weight as influenced by pregnancy nutrition of multiparous ewes. *Journal of Animal Science*, 96, 1962-1977. <https://doi.org/10.1093/jas/sky072>.
- GARDNER D.S., BUTTERY P.J., DANIEL Z., SYMONDS M.E. (2007): Factors affecting birth weight in sheep: maternal environment. *Reproduction*, 133, 1, 297-307. doi:10.1530/REP-06-0042.
- GASKINS C. T., SNOWDER G. D., WESTMAN M. K., EVANS M. (2005): Influence of body weight, age, and weight gain on fertility and prolificacy in four breeds of ewe lambs. *Journal of Animal Science*. 83, 1680-1689. <https://doi.org/10.2527/2005.8371680x>.
- GUNN R.G., SIM D.A., HUNTER E.A. (1995): Effect of nutrition in utero and early life on the subsequent lifetime reproductive performance of Scottish Black face ewes in two management systems. *Animal Science*, 60, 223-230.
- PETROVIĆ P.M., CARO PETROVIĆ V., RUŽIĆ-MUSLIĆ D., MAKSIMOVIĆ N., PETROVIĆ M.M., ILIĆ Z., STOJKOVIĆ J. (2015): Effect of genetic and environmental factors on the phenotype characteristics of lambs. *Biotechnology in Animal Husbandry*, 31, 2, 223-233.

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- PETROVIĆ P.M., CARO PETROVIĆ V., RUŽIĆ-MUSLIĆ D., MAKSIMOVIĆ N., ILIĆ Z., MILOSEVIC B., STOJKOVIC J. (2012): Some important factors affecting fertility in sheep. *Biotechnology in Animal Husbandry*, 28, 3, 517-528.
- PETROVIĆ P.M., RUŽIĆ-MUSLIĆ D., MAKSIMOVIĆ N. (2009): Evaluation of genetic potential of sheep in different production systems. *Biotechnology in Animal Husbandry*, 25, 5-6, 421-429.
- PURUSHOTAM J. (2022): Nutrition and Reproduction in Sheep. *Food & Agribusiness Management*, 3, 2, 48-52.
- VAN DER LINDEN D., KENYON P., LOPEZ-VILLALOBOS N., JENKINSON C., PETERSON S., BLAIR H. (2010): Effects of ewe size and nutrition during pregnancy on performance of 2-year-old female offspring. *The Journal of Agricultural Science*, 14, 4, 465-475. doi: 10.1017/S0021859610000274.
- VLAHEK I., SUŠIĆ V., EKERT KABALIN A., MENČIK S., MAURIĆ MALJKOVIĆ M., PIPLICA A., ŠAVORIĆ J., FARAGUNA S. (2023): Prediction of reproductive performance of ewes based on the early production data, ewe birth rank, dam age, and dam birth rank. *Archives Animal Breeding*, 66, 145–151. <https://doi.org/10.5194/aab-66-145-2023>.

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