

INFLUENCE OF NON-GENETIC FACTORS ON THE ANNUAL MILK PRODUCTION OF OVCHEPOLIAN SHEEP IN THE REPUBLIC OF MACEDONIA

UTJECAJ NEGENETSKIH ČIMBENIKA NA GODIŠNJU MLIJEČNOST OVČEPOLJSKE OVCE U REPUBLICI MAKEDONIJI

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SUMMARY

During four production years (2002, 2003, 2004 and 2005), several production traits were tested in a total of 180 Ovchepolian sheep. The age of the sheep was from first to the seventh lactation and 4319 individual lactation tests were performed. Besides the basic statistics, the data were analyzed by multi trait fixed model. The influence of certain factors was studied with the F-test, and the differences between the LS – estimates of every effect were determined with the T-test. The analyses were performed by the set of programs SPSS. The factors year and lactation had a highly significant influence ($P < 0.01$) on the annual milk production traits. The month of lambing manifested a highly significant influence ($P < 0.01$) on several traits (lactation and commercial milk, the lactation length), and ($P < 0.05$) on the milk suckled by the lambs. However this factor did not have any influence on the suckling period length ($P > 0.05$). Regarding the four traits, the fertility did not manifest any influence ($P > 0.05$). The average annual milk production of tested sheep population for the four years was 53 ± 0.247 L, while the amount of suckled milk was on average 20 ± 0.130 L. The maximum annual milk production in this population was recorded in 2003 (109.75 L). The production of commercial milk was on average 33 ± 0.217 L, while the average length of the suckling period was 57 ± 0.377 days. The lactation period length for these sheep was on average 180 ± 0.31 days for the four testing years.

Key words: Ovchepolian sheep, production traits, factors influence (year, lactation, lambing month, fertility)

INTRODUCTION

The sheep population in the Republic of Macedonia is composed mostly of the crossbreeds, created as a result of crossbreeding between two indigenous types of pramenka (Ovchepolian and Sharplaninian), with numerous merino breeds (Merino d'arl, Merino d'lest etc.), (Pacinovski et al.,

2006.). The average annual production of this population is similar to that of other types of pramenka in the Balkan, and that is 50-60 L of total lactation milk, 1,5 kg wool, 35-40 kg lamb live weight, 100-110% fertility, 3-5% of twins (MAFWE, 2000).

The low production traits of these sheep are a reason for undertaking activities to improve them, ei-

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ther through constant paragenetic factors improvement i.e. breeding conditions or through promoting the genetic potential (through constant and continuous sheep selection or through crossbreeding with other breeds).

In order to analyze several production traits from more aspects, the influence of certain factors on the annual milk production in Ovchepolian sheep is shown in this paper.

MATERIAL AND METHODS

As the basic research material in the study that lasted 4 years (2002-2005), Ovchepolian sheep was included. The sheep were located on a farm in the area of Skopje.

The number of sheep included in the study was the following: 167 in the year 2002, 198 in 2003, 189 in 2004 and 170 in 2005 or total of 724 Ovchepolian sheep were studied in four production years (Table 1).

The sheep were from first to seventh lactation, but most of them were between the 3rd and 6th lactation (Table 2).

During four production years total of 4319 individual milk recordings were performed or according to parity: 287 in the first lactation, 480 in the second, 833 in the third, 839 in the fourth, 841 in the fifth, 697 in the sixth and 342 in the seventh lactation (Table 3).

A combined (barn-pasture) system of husbandry was used, which comprises vegetation during 7-8 months, while in the rest of the year, the sheep were fed meadow hay (November-February) and concentrate mixture (November-April).

The lambs were with mothers till the age of 2-2.5 months, after that, the milking period started and lasted approximately from the end of July until the middle of August.

The milk production of sheep was monitored by a standard A4 method (ICRPMA, 1990), which compromised daily milk production measurement per

Table 1. Number of tested sheep per year

Tablica 1. Broj testiranih ovaca po godinama

Population - Populacija	Year - Godina				Total - Ukupno
	2002	2003	2004	2005	
Ovchepolian sheep - Ovčepoljska ovca	167	198	189	170	724

Table 2. The parity of the tested sheep per year

Tablica 2. Paritet testiranih ovaca po godinama

Year - Godina	Lactation in order – Redosljed laktacije							Total –Ukupno
	I	II	III	IV	V	VI	VII	
2002	18	33	59	31	18	8	/	167
2003	30	18	33	59	31	19	8	198
2004	/	30	18	33	59	30	19	189
2005	/	/	30	18	32	59	31	170
Total - Ukupno	48	81	140	141	140	116	58	724

Table 3. Individual sheep lactation tests

Tablica 3. Pojedinačni test laktacije ovaca

Year - Godina	Lactation in order – Redosljed laktacije							Total - Ukupno
	I	II	III	IV	V	VI	VII	
2002-2005	287	480	833	839	841	697	342	4319

head, in the interval from 28 to 34 days. The milk controls started 10 days after lambing and lasted until the ewes were dried off (beginning of August). Total of 6 milk controls were realized.

Based on these lactation measurements, the following was examined:

- Total production of milk per lactation in liters (L);
- Total production of milked milk per lactation in liters (L);
- Amount of milk consumed by the lambs in liters (L);
- Length of suckling period in days;
- Lactation length in days.

Mean values on all of these traits were determined based on 4319 individual lactation tests (Table 3).

Regarding the statistical analysis, the traits of the annual milk production (lactation milk, suckling and commercial milk, suckling period, lactation length) were analyzed by the following multi trait fixed model:

$$Y = \mu + Y_j + L_k + MBI + F_m + e_{jklm}$$

where:

Y – is individual observation of every trait in the annual testing (lactation milk, suckling and commercial milk, suckling period length, lactation length);

μ - is basic, collective average for the researched traits;

Y_j – effect of j year with (j = 2002, 2003, 2004 and 2005);

L_k – effect of k lactation with (k = 1, 2, 3, 4, 5, 6, 7);

MBI – effect of l month of lambing with (l = December, January, February, March);

F_m – effect of m number of newborn lambs with (m = 1, 2);

e_{jklm} – residual influence

The separate traits influence was studied by the F-test, and the differences between LS – estimates of each effect were determined by the T-test.

The analyses were made by the set of programs SPSS (SPSS, 1994).

RESULTS AND DISCUSSION

The year and lactation had a highly significant influence ($P < 0.01$) on the traits of annual milk production in the tested sheep population (Table 4).

The lambing month had a highly significant influence ($P < 0.01$) on lactation, the milked milk amount and the lactation length, a significant influence ($P < 0.05$) on the suckling milk amount, while this factor did not show any influence on the length of the suckling period. Fertility did not have any influence ($P > 0.05$).

The determination coefficient for the tested traits in these sheep was from 0.347 for the suckling period length to 0.761 for lactation milk.

The influence of these factors in details is shown in the next tables (Table 6 – Table 9).

Annual milk production in Ovchepolian sheep

The average lactation in this sheep population for the four years was 53 ± 0.247 L, while the milk consumed by the lambs was on average 20 ± 0.130 L. The commercial milk production in this population was on average 33 ± 0.217 L for four years, while the average suckling period length was 57 ± 0.377 days. The lactation length was on average 180 ± 0.31 days. Analyzing the minimal and maximal values of annual milk production for every of the four years, a big variation of these values is noted.

The obtained results for the annual milk production in Ovchepolian sheep are in accordance with those in the literature. The average annual lactation

Table 4. Influence of difference factors on the annual milk production in Ovchepolian sheep, F-test and its significance (F-statistics)

Tablica 4. Utjecaj različitih čimbenika na godišnju proizvodnju mlijeka ovčepoljske ovce, F-test i signifikantne razlike (F-statistika)

Factor – Čimbenik	Df – Rf	Lactation milk yield – Količina mlijeka u laktaciji	Suckling milk – Posisano mlijeko	Milking milk – Komercijalno mlijeko	Suckling period length – Duljina sisanja	Lactation length – Duljina laktacije
Year - Godina	3	5.816***	29.440***	4.340**	100.190***	35.611***
Lactation - Laktacija	6	37.497***	27.264***	10.326***	4.533***	4.079***
Month of lambing - Mjesec janjenja	3	84.971***	3.387*	99.620***	2.219 ^{ns}	265.511***
Fertility - Oplodenost	1	0.615 ^{ns}	1.050 ^{ns}	0.766 ^{ns}	1.451 ^{ns}	0.085 ^{ns}
R ²	/	0.761	0.553	0.612	0.347	0.736

Table 5. Annual milk production in the Ovchepolian sheep, LS – mean ± SE

Tablica 5. Godišnja proizvodnja mlijeka ovčepoljske ovce

Year - Godina	Parameter – Pokazatelj	Lactation milk, L – Mlijeko u laktaciji	Suckling milk, L – Posisano mlijeko	Milking milk, L - Komercijalno mlijeko	Suckling period length, (days) – Duljina sisanja (dani)	Lactation length, (days) – Duljina sisanja (dani)
2002	\bar{x}	49	18	31	66	171
	Cv	29.17	27.67	26.44	15.88	9.67
	min-max	20.40 – 106.50	7.70 – 49.64	12.70 – 61.57	40 - 77	128 - 195
2003	\bar{x}	56	25	31	64	187
	Cv	18.69	27.07	20.88	17.06	3.76
	min-max	33.46 – 109.75	3.96 – 47.04	24.61 – 66.63	47 - 84	198 - 217
2004	\bar{x}	52	17	35	49	180
	Cv	18.02	20.14	27.72	11.55	8.46
	min-max	25.75 – 85.15	11.00 – 30.74	10.12 – 61.93	42 - 58	149 - 197
2005	\bar{x}	54	18	36	50	181
	Cv	17.68	20.01	23.99	9.80	8.42
	min-max	29.15 – 82.57	11.16 – 34.76	9.36 – 56.74	36 - 79	142 - 207
Average - Prosjek		53± 0.247	20±0.130	33±0.217	57±0.377	180±0.31

ns – P>0.05, * - P<0.05, ** - P<0.01, *** - P<0.001

of 49, 56, 52 and 54 L milk for four testing years (2002, 2003, 2004 and 2005) are in accordance with the lactation results of this population, given by different authors (Shokarovski, 1957., Tashkovski, 1962., Tashkovski et al., 1968., Tashkovski and Tokovski, 1969., Tokovski et al., 1977., Tokovski et al., 1988., Kozarovski et al., 1989., Shokarovski et al., 1992.).

Compared to our results, Shokarovski et al. (1992.) determined significantly lower amount of milked milk in Ovchepolian sheep, and according to them the average milking milk production was 17.31 kg. This is almost 100% less than in our testing, to which the authors point as the basic reason for low sheep farm cost-effectiveness with this sheep population in the R. of Macedonia. Kozarovski et al. (1989.) determined similar amount of milking milk in traditionally and intensively bred Ovchepolian sheep population, and according to them in the former they determined 28.35 L milking milk, and in the latter 34 L.

The determined annual milk production in our tests was significantly lower than that determined in few indigenous sheep breeds in the Balkan: 100 kg in Lipe sheep in Serbia, 120 kg in Istrian sheep in Croatia, 90-120 kg in Dubian sheep in Bosnia and Herzegovina, 100-110 kg of milk in Pivska sheep in Montenegro, 90-130 kg in Rechka sheep in Albania (Porchu and Markovich, 2006.).

Most of the authors working on determining the lactation length in Ovchepolian sheep, determined an average length of around 180 days, which is in accordance with the results of our tests (Tashkovski, 1962., Tokovski et al., 1977., Tokovski et al., 1988., Todorovski et al., 1996.). There are also authors who determined significantly shorter lactation in this sheep population. Tashkovski et al. (1968.) determined 162 days lactation length in Ovchepolian sheep. It is hard to find the reasons why so short lactation, but it usually happens in dry years or in the year when the lambing is very late in the year (March-April), so lactation shortens.

The influence of the year on the annual milk production in Ovchepolian sheep

The year significantly influenced ($P < 0.001$) all of the annual milk production traits in Ovchepolian sheep population (Table 4).

According to Table 6, the average lactation milk production in Ovchepolian sheep was 49 ± 1.25 L in 2002 and 56 ± 1.27 L in 2003. The lambs suckled from 18 L in 2002 and 2005, to 25 ± 0.71 L in 2003. The milking milk production was 33 L on average during four years, while the suckling period length in this population was from 49 days in 2004 to 66 days in 2002. The average lactation length in Ovchepolian sheep was 171 day in 2002, when the shortest, to 187 days in 2003, when it was the longest. These data are similar to the results of Tokovski et al., (1977.), for lactation length in Ovchepolian sheep (180 days).

Lactation influence on annual milk production in Ovchepolian sheep

The parity number significantly influenced ($P < 0.001$) the tested traits of the annual milk production in Ovchepolian sheep (Table 4).

According to Table 7, the lactation milk yield in Ovchepolian sheep, reached its maximum in the 3rd (66 ± 1.25 l) and 4th (60 ± 1.27 l) lactation, and after that decreased until the seventh lactation. The milking milk amount was the highest in these two lactations (3rd and 4th), as well as the amount of milk consumed by the lambs. The suckling period length was equal and lasted from 55 days in the first to 59 days in the third lactation. The average lactation length in these sheep was 180 days from the first to the seventh lactation.

Lambing month influence on the annual milk production in Ovchepolian sheep

The lambing month had a significant influence ($P < 0.001$) on the lactation and milking milk yields, as well as on the lactation length. This factor significantly influenced ($P < 0.05$) the amount of milk suckled by the lambs, while it did not have any influence on suckling period length (Table 4).

According to the data in Table 8, the Ovchepolian population sheep that lambed the earliest in the production year i.e. in December, reached the highest annual milk production (59 ± 1.32 L) and those that lambed the latest i.e. in March, had the lowest milk production (43 ± 1.37 L).

Table 6. The year influence on the annual milk production in Ovchepolian sheep, LS - mean \pm SE

Tablica 6. Utjecaj godine na godišnju proizvodnju mlijeka ovčepoljske ovce

Year - Godina	n	Lactation milk, L – Mlijeko u laktaciji	Suckling milk, L – Posisano mlijeko	Milking milk, L - Komerrijalno mlijeko	Suckling period length, (days) – Duljina sisanja (dani)	Lactation length, (days) – Duljina sisanja (dani)
2002	167	49 \pm 1.25	18 \pm 0.70	31 \pm 0.90	66 \pm 1.14	171 \pm 0.55
2003	198	56 \pm 1.27	25 \pm 0.71	31 \pm 0.92	64 \pm 1.16	187 \pm 0.56
2004	189	52 \pm 1.27	17 \pm 0.70	35 \pm 0.91	49 \pm 1.15	180 \pm 0.55
2005	170	54 \pm 1.28	18 \pm 0.71	36 \pm 0.92	50 \pm 1.17	181 \pm 0.56

Table 7. The lactation influence on the annual milk production in Ovchepolian sheep, LS - mean \pm SE

Tablica 7. Utjecaj laktacije na godišnju proizvodnju mlijeka ovčepoljske ovce

Lactation in order - Redosjed laktacije	n	Lactation milk, L – Mlijeko u laktaciji	Suckling milk, L – Posisano mlijeko	Milking milk, L - Komerrijalno mlijeko	Suckling period length, (days) – Duljina sisanja (dani)	Lactation length, (days) – Duljina sisanja (dani)
1	287	47 \pm 1.37	16 \pm 0.76	31 \pm 0.99	55 \pm 1.25	178 \pm 0.59
2	480	51 \pm 1.30	18 \pm 0.72	33 \pm 0.94	56 \pm 1.19	180 \pm 0.57
3	828	66 \pm 1.25	25 \pm 0.70	41 \pm 0.90	59 \pm 1.14	181 \pm 0.55
4	833	60 \pm 1.27	23 \pm 0.71	37 \pm 0.91	58 \pm 1.16	180 \pm 0.56
5	835	53 \pm 1.26	19 \pm 0.70	34 \pm 0.91	57 \pm 1.15	181 \pm 0.56
6	691	48 \pm 1.28	17 \pm 0.71	31 \pm 0.92	58 \pm 1.16	181 \pm 0.56
7	342	46 \pm 1.32	16 \pm 0.73	30 \pm 0.95	58 \pm 1.20	181 \pm 0.57

Table 8. The influence of the month of lambing on the annual milk production in Ovchepolian sheep, LS - mean \pm SE

Tablica 8. Utjecaj mjeseca janjenja na godišnju proizvodnju mlijeka ovčepoljske ovce

Month of lambing – Mjesec janjenja	n	Lactation milk, L – Mlijeko u laktaciji	Suckling milk, L – Posisano mlijeko	Milking milk, L - Komerrijalno mlijeko	Suckling period length, (days) – Duljina sisanja (dani)	Lactation length, (days) – Duljina sisanja (dani)
12	582	59 \pm 1.32	19 \pm 0.73	40 \pm 0.95	58 \pm 1.20	208 \pm 0.49
1	2879	57 \pm 1.22	19 \pm 0.68	38 \pm 0.88	56 \pm 1.12	196 \pm 0.46
2	630	52 \pm 1.28	20 \pm 0.71	32 \pm 0.92	56 \pm 1.16	174 \pm 0.48
3	205	43 \pm 1.37	18 \pm 0.76	25 \pm 0.99	58 \pm 1.25	142 \pm 1.28

Table 9. The influence of the fertility on the annual milk production in Ovchepolian sheep, LS - mean ± SE

Tablica 9. Utjecaj oplodnosti na godišnju proizvodnju mlijeka ovčepoljske ovce

Fertility – Oplodnost	n	Lactation milk, L – Mlijeko u laktaciji	Suckling milk, L – Posisano mlijeko	Milking milk, L - Komercijalno mlijeko	Suckling period length, (days) – Duljina sisanja (dani)	Lactation length, (days) – Duljina sisanja (dani)
1	3362	56±0.23	20±0.13	36±0.17	56±0.21	180±0.31
2	934	57±0.34	21±0.19	36±0.25	57±0.31	180±0.32

The amount of milking and suckled milk showed the same trend, while the suckling period length was 56 days for sheep that lambed in January and February and 58 days for those that lambed in December, i.e. March. The lactation length in this population was from 142±1.28 days for sheep that lambed in March, to 208±0.49 days for sheep that lambed in December.

The average annual milk production (53±0.247 L), as well as the determined minimal (20.40 L) and maximal (109.75 L) milk production in controlled sheep, point to the possibility of promoting the genetic capacity in terms of milk production in this population with conducting a continuous and permanent selection, in addition to crossbreeding of other breeds.

Fertility influence on the annual milk production in Ovchepolian sheep

The fertility did not have any influence on either of the tested traits in Ovchepolian sheep (Table 4). According to the data in Table 9, the sheep with two lambs had a slightly higher annual milk production (57±0.34 L) than those with one lamb (56±0.23 L). The suckling period length was also insignificantly higher in sheep with twins, while the lactation length was the same in the two groups.

CONCLUSIONS

Based on the results of this study, performed on Ovchepolian sheep, the following conclusions can be made:

The fact that the year had a significant influence ($P < 0.001$) on the annual milk production traits, confirms the thesis that the greatest attention should be paid to sheep nutrition in order to obtain higher milk production, regardless of the genetic capacity.

Considering the lactation number influence on the studied traits, it can be recommended that the sheep of this population are not used in production more than 6 years, except certain individual animals with above average milk production.

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SAŽETAK

Cilj ovoga rada bio je utvrditi neke proizvodne odlike ovčepoljske ovce (n=180). Istraživanje je provedeno u razdoblju od 2002. do 2005. godine, a ukupno je analizirano 4319 individualnih kontrola mlječnosti ovaca od prve do sedme laktacije. Dobiveni rezultati analizirani su višefaktorijskim fiksnim modelom (SPSS). Utjecaj pojedinih čimbenika utvrđen je uz pomoć F-testa, a razlike između LS ocjene svakog utjecaja utvrđene su T-testom. Utjecaji godine i laktacije bili su visoko značajni ($P < 0,01$) kod svih navedenih osobina mlječnosti ovaca tijekom godine. Mjesec janjenja imao je visoko značajni utjecaj ($P < 0,01$) na količinu mlijeka i trajanje laktacije te značajan ($P < 0,05$) utjecaj na količinu posisanoga mlijeka, dok na dužinu razdoblja sisanja nije imao značajan utjecaj ($P < 0,05$). Plodnost nije imala nikakav utjecaj na proizvodne osobine ovčepoljske ovce ($P < 0,05$). Prosječna količina mlijeka u laktaciji istraživane populacije ovaca, tijekom sve četiri godine, bila je $53 \pm 0,247$ L, dok je količina posisanog mlijeka iznosila u prosjeku $20 \pm 0,130$ L. Najveća količina mlijeka tijekom laktacije utvrđena je tijekom 2003. godine te je iznosila 109,75 L. Proizvodnja komercijalnog mlijeka bila je u prosjeku $33 \pm 0,217$ L dok je prosječna dužina razdoblja sisanja bila $57 \pm 0,377$ dana. Prosječna dužina laktacije tijekom istraživanja bila je $180 \pm 0,31$ dana.

Ključne riječi: ovčepoljska ovca, proizvodne osobine, godina, laktacija, mjesec janjenja, plodnost.