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PRODUCTIVITY OF MILK AND MILK COMPOSITION OF AN INDIGENOUS SHEEP BREED IN MACEDONIA[1]

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Abstract: Several production traits have been examined in 180 Ovchepolian sheep during a four-year production period (2010–2013). The sheep ranged in age from the first to the 7th lactation and 4319 individual lactation controls were realized in total. Besides the basic statistics, all data were analysed using a multi-factorial fixed model. The influence of certain factors was studied using the F-test and the analyses were made using the SPSS set of programs. Most of the factors (year, lactation, lambing month and number of milk recording) had a highly significant influence ($P<0.001$) on daily milk production (milk from the morning, evening and the total amount of milk, % of milk fat and kg fat) in this breed of sheep. The month of milk recording also had a significant influence ($P<0.05$) on all traits. Only fertility had no impact on the variations in the tested parameters, aside from the total daily milk, on which a highly significant influence was manifested ($P<0.01$). The average milk lactation among the tested sheep population during all four years was, on average, 58 ± 0.247 l, while the production of milked milk for the same period was 37 ± 0.217 l. The length of the lactation period in these sheep for the four years studied averaged 182 ± 0.31 days. The maximal daily milk yield in this sheep population was measured in 2011 (0.302 ± 0.26 l). Regarding their age, the highest daily milk yield was determined in sheep in the third lactation (0.365 ± 0.26), while those in the 7th lactation had the lowest (0.255 ± 0.27).

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Key words: Ovchepolian sheep, daily milk production; fat %; fat kg; influencing factors

Introduction

Of the ten total genotypes (Ovchepolian, Sharplaninian, Karakachanian, Würtemberg, Würtemberg crossbreeds, Awassi, Awassi crossbreeds, East-Friesian, Sardinian crossbreeds, Pleven Blackead sheep) provided in the system for registration and identification in Macedonia, Ovchepolian sheep represent the population with the greatest significance for sheep breeding in the country. Their importance emanates both from their sheer numbers and by virtue of their possessing the largest total productivity. Besides Sharplaninian and Karakachanian sheep, the Ovchepolian sheep is one of three indigenous breeds; therefore, this breed is a target for the protection of biodiversity in sheep breeding in Macedonia. This breed has simple production parameters: 45 kg live weight rams, 36 kg adult sheep. The lactation period is 191 days and average milk lactation (annual) is 72.49 kg, with large variations from 38.74 – 91.28 kg. Fertility is at a high level (100%), while the percentage of twinning is quite low, 5–6%. It is present on about 2/3 of the territory of the country and it represents about 60% of the total sheep population in the Republic of Macedonia *(Porcu and Markovic, 2006)*.

Due to its low production traits, in the past the breed has often been the subject of crossbreeding with other imported breeds (Awassi, Würtemberger and other Merino breeds) in order to advance certain traits (milk yield, live weight, growth, wool, etc.) *(Pacinovski et al., 2006)*. An attempt was made in this work to determine the influence of certain paragenetic factors on daily milk production in this breed of sheep; in other words, an attempt to determine the level of influence of many factors such as genotype, year, lactation, lambing month, month of milk recording, number of milk recording and fertility on daily milk production and the percentage and quantity of milk fat produced.

Keeping in mind the fact that the selection of dairy sheep populations depends greatly on proper control of daily milk production, breeders work constantly on improving the methods for scoring this type of sheep, whereupon as a significant progress in this field is the usage of the so-called “test-day” model. However, according to most of them, success in this selection depends greatly on knowledge of the factors affecting milk production on the day of milk recording, and they influence milk yield throughout lactation and the milking period.

Material and Methods

The basic experimental material was the Ovchepolian sheep, located on a farm in the Shtip surrounding. The number of sheep involved in the four year

survey (2010–2013) were as follows: 167 sheep in 2010, 198 in 2011, 189 in 2012 and 170 in 2013; during four years of production 724 sheep were studied in total (Tab. 1).

Table 1. Number of tested sheep per year

Breed	Year				Total
	2010	2011	2012	2013	
Ovchepolian sheep	167	198	189	170	724

According to age group, the sheep ranged in age from the first to the 7th lactation, with most between the third and the sixth lactation (Tab. 2).

Table 2. The age range of the tested sheep per year

Year	Lactation number							Total
	I	II	III	IV	V	VI	VII	
2010	18	33	59	31	18	8	/	167
2011	30	18	33	59	31	19	8	198
2012	/	30	18	33	59	30	19	189
2013	/	/	30	18	32	59	31	170
Total	48	81	140	141	140	116	58	724

During the four years of production there were 4319 individual lactation tests realized in total, ranging according to age as follows: 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 7th lactation (Tab. 3).

Table 3. Lactation tests on individual sheep

Year	Lactation number							Total
	I	II	III	IV	V	VI	VII	
2010–2013	287	480	833	839	841	697	342	4319

A combined (barn-pasture) farming system that includes use of available vegetation during 7–8 months, while the rest of the year the sheep were additionally fed with meadow hay (November–February) and concentrate (November–April), has been applied on this farm.

Lambs were with their mothers until the age of 2–2.5 months, while milk production by the sheep was followed by a standard A4 method *(ICAR, 2009)* that involves measuring the daily production of milk per head at intervals of 28 to 34 days.

The milk recording started 10 days after lambing and lasted until the moment of drying (early August). During the suckling period, with reference to the moment, the milk recording was made such in a way that the lambs were separated

from their moms for the morning milk control, 12 hours before the milk recording. Afterward, the lambs were returned to their mothers for 24 hours, after which they were separated again for the morning milk control, 12 hours before the evening milk recording was made. There were 6 milk measurements realized in total, and from each of them a collective individual milk sample of 50 ml (at least 25 ml from each milking) was taken for milk fat analysis. Based on these milk yield measurements, the following was calculated:

– Total milk production of one lactation, in litres (l);
– Total milked milk of one lactation, in litres (l);
– Amount of milk consumed by lambs, in litres (l);
– Suckling period length in days;
– Length of lactation, in days.

- The lactation milk is calculated by multiplying the length of a lactation period (days) and an average daily milk production (litres) during the whole lactation, while the milk production during a suckling period is calculated by multiplying the length of a suckling period (days) and an average daily milk production (litres) during the whole lactation.

Concerning the statistical processing, the traits of daily milk production (morning, evening and total amount of milk, % of fat and kg fat) were analysed using the following model:

$$Y = \mu + G_i + Y_j + L_k + MB_l + TD_m + TM_n + F_o + eijklmno$$

where:

– Y is an individual observation of each trait during a (daily) test (milk from the morning, evening and total amount of milk, % of fat, milk fat kg);
– μ is the general common average of the tested traits;
– G_i is the effect of the i-th genotype, with (i = Ovchepolian sheep);
– Y_j is the effect of the j-th year, with (j = 2010, 2011, 2012 and 2013);
– L_k is the effect of the k-th lactation, with (k = 1, 2, 3, 4, 5, 6, 7);
– MB_l is the effect of the l-th lambing month (l = December, January, February, March);
– TD_m is the effect of the m-th recording day, with (m = 1, 2, 3, 4, 5, 6);
– TM_n is the effect of the n-th recording month, with (n = February, March, April, May, June, July);
– F_o is the effect of the o-th number of newborn lambs, with (m = 1, 2);
– eijklmno is the residual influence.

The influence of certain effects was studied using the F-test, while statistical analyses were performed with Statistical Package *SPSS (2004) version 13*.

Results and Discussion

Average values of traits: According to the data in Table 4, the average milk lactation (annual) in the Ovchepolian sheep was 58 ± 0.247 l for the four tested years, while the amount of milked milk produced for the same period was 37 ± 0.217 l. During the suckling period, which is on average 65 days, the lambs from this population had an average lactation of 182 days. The results from our surveys on annual milk production in Ovchepolian sheep are also congruent with those in the literature, with some exceptions.

A slightly higher milk lactation yield (68.31 l) in this sheep population was found by *Todorovski et al., (1988),* but at the same time they found a lower content of milk fat, 5.59%. *Tashkovski et al., (1968)* also found a higher annual milk yield (64.38 l) in Ovchepolian sheep. A similar milk yield in Ovchepolian sheep has also been reported by many other authors, with a few exceptions *(Shokarovski, 1957; Tashkovski, 1962; Tashkovski and Tokovski, 1969; Tokovski et al., 1977; Shokarovski et al., 1992).*

Compared with our results, *Shokarovski et al., (1992)* determined a significantly lower amount of milking milk in a domestic sheep population, whereby the average milked milk of sheep was 17.31 kg.

This is almost a 50% less amount of milking milk with reference to our surveys, which the authors point to as a major reason for the low profitability of sheep farms in the Republic of Macedonia, where this sheep population is farmed.

A very similar amount of milked milk in traditionally and intensively farmed sheep from a domestic population was determined by *Kozarovski et al., (1989),* according to which in the first the average milk yield of 34 l milked milk is determined and in the second it is 28.35l.

Table 4. Descriptive statistical data on the investigated Ovchepolian sheep dairy traits, LS – mean ± SE

Parameter	N	Mean	Min	Max	Std. deviation	Cv
Lactation milk (litres)	181	58 ± 0.247	27	96	10.92	20.60
Suckling milk (litres)	181	21 ± 0.130	9	41	4.69	23.45
Milking milk (litres)	181	37 ± 0.217	14	62	8.25	25.00
Length of suckling period (days)	181	65 ± 0.194	41	75	8.00	14.04
Length of lactation (days)	181	182 ± 0.310	154	204	13.51	7.51
Morning milk yield (litres)	4319	0.152 ± 0.001	0.05	0.36	42.07	27.68
Evening milk yield (litres)	4319	0.169 ± 0.001	0.05	0.40	49.09	29.05
Total daily milk yield (litres)	4319	0.321 ± 0.02	0.06	0.74	88.37	27.62
Fat (%)	4319	7.77 ± 0.010	5.2	9.89	0.70	9.01
Daily fat yield (kg)	4319	0.025 ± 0.002	0.004	0.06	0.006	24.00

The determined annual milk production in the indigenous sheep population tested is significantly less than that found in other autochthon sheep breeds in the Balkans: 100 kg in Lipe sheep in Serbia, 120 kg in Istrian sheep in Croatia, 90–120 kg in Dubian sheep in Bosnia and Hercegovina, 100–110 kg in Pivska sheep in Montenegro, and 90–130 kg in Rechka sheep in Albania etc. *(Porchu and Markovic, 2006)*.

The length of the suckling period as a production stage in sheep breeding depends on many factors. Mainly it is the breeder's decision, on the basis of the farming system used, the breed, the intended use of the lambs (replacement, for meat) etc. Normally, breeding lambs have a longer suckling period than lambs for producing lamb meat. This period is intended to be shorter in the intensive production system in order to increase the profitability of the farm. In any case, this is a very important factor on which the production of milked milk and the growth of the lambs depend. An already proven technology for early-weaned lambs, according to which the amount of suckled milk could be reduced to a minimum and the amount of milked milk to a maximum, was not accepted by sheep breeders in Macedonia and required hiring an additional labour force. Generally, the length of the suckling period according to the traditional technology used in Macedonia is, on average, 2 to 2.5 months, and this technology is used by many sheep breeders in the country *(Shokarovski et al., 1992)*.

Most authors who have worked on establishing the length of lactation in indigenous sheep populations have determined an average length of 180 days, which is in accordance with our survey results *(Tashkovski, 1962; Tokovski et al., 1977; Tokovski, et al., 1988; Todorovski et al., 1996)*. However, there are authors who measured a significantly shorter lactation in this population. *Tashkovski et al., (1968)* reported 162 days of lactation in Ovchepolian sheep. It is hard to determine the reasons for such a brief lactation, but this usually occurs in extremely dry and meagre years when the lambing of the sheep is very late in the year (March–April), so lactation is shortened out of necessity. However, this forced shortening occurs in only a small number of sheep (generally 3–5% of the sheep in the flock) that experienced late fertilization outside of the normal season, so the first assumption remains to be proven.

Most authors who have worked on establishing the percentage of milk fat in domestic sheep populations determined a somewhat lower percentage of milk fat. *Tashkovski et al., (1968)* reported 7.28% in Ovchepolian sheep, while *Tokovski et al., (1988),* measured an average content of milk fat of 5.59 or 5.41 in Ovchepolian sheep and Ovchepolian Pramenka. *Tashkovski, (1962)* determined 5.41% milk fat in Ovchepolian Pramenka, with variations from 4.62% to 6.31%, and, according to *Todorovski et al., (1996),* the percentage of milk fat in Ovchepolian and the Sharplaninian sheep was 5.41 or 6.41%. The smaller percentage of milk yield reported by these authors compared to the higher

percentage obtained from our surveys was due to paragenetic dietary factors, which depend greatly on the content of fat.

Influence of the factors: Analysing the results in Table 5, it can be concluded that most of the factors (year, lactation, lambing month and number of milk recording) have a significant influence ($P < 0.001$) on daily milk production (morning, evening and total amount of milk, % of fat and fat kg) in this sheep breed. The month in which the milk was measured also had a significant influence ($P < 0.001$), except with no effect on the % of milk fat ($P < 0.05$).

Only fertility had no influence on the variation in the parameters examined, with the exception of the total amount of daily milk, on which a highly significant influence was manifested ($P < 0.01$).

The determination coefficients for the examined factors in these sheep ranged from 0.326 for % of milk yield to 0.689 for total daily milk. *Pacinovski et al., (2014)* determined a similar influence of almost all factors mentioned, with the exception of fertility, on daily milk production in Awassi sheep.

Table 5. Factors influencing daily milk production in Ovchepolian sheep, F-test and its significance (F-statistics)

Factor	Df	Morning	Evening	Total	Fat (%)	Fat (kg)
Year	3	3.694*	18.240***	5.525***	79.164***	13.829***
Lactation	6	98.114***	156.477***	140.096***	29.597***	116.759***
Month of lambing	4	10.361***	9.367***	10.763***	9.503***	11.123**
Month of milk recording	6	54.256***	35.890***	49.180***	1.004^{ns}	30.941***
No of milk recordings	6	52.572***	50.380***	56.046***	9.304***	33.870***
Fertility	1	0.00^{ns}	0.273^{ns}	0.078**	1.117^{ns}	0.446^{ns}
R^2 – Coef. of determination	/	0.646	0.685	0.689	0.326	0.627

ns – P > 0.05; * – P < 0.05; ** – P < 0.01; *** – P < 0.001

In Ovchepolian sheep, the year also had a highly significant influence ($P < 0.001$) on most of the daily milk production characteristics examined, with the exception of morning milk, on which a significant influence was manifested ($P < 0.05$) (Tab. 5). *Kastelic et al., (2013)* determined a highly significant influence of the year on milk production and milk yield in Istrian sheep, an indigenous breed in Slovenia and Croatia. *Pacinovski et al., (2013)* determined a similar influence of the year on lactation in East Friesian sheep in Macedonia. According to the data in Table 6, the average daily milk productivity in these sheep was the highest in 2011 (0.302 ± 0.26 l) and the lowest in 2010 (0.285 ± 0.26 l). The percentage of milk fat was also the highest in 2013 ($7.90 \pm 0.10\%$) and the lowest in 2011 and 2012 ($7.59 \pm 0.10\%$). The daily production of milk fat ranged from 0.022 kg in 2010, 2011 and 2012 to 0.024 kg in 2013.

Table 6. The influence of the year on daily milk production in Ovchepolian sheep, LS-mean ± SE

Year	N	Morning (litres)	Evening (litres)	Total (litres)	Fat (%)	Fat (kg)
2010	167	0.137 ± 0.01	0.148 ± 0.01	0.285 ± 0.26	7.82 ± 0.10	0.022 ± 0.02
2011	198	0.136 ± 0.01	0.166 ± 0.01	0.302 ± 0.26	7.59 ± 0.10	0.023 ± 0.02
2012	189	0.134 ± 0.01	0.157 ± 0.01	0.291 ± 0.26	7.59 ± 0.10	0.022 ± 0.02
2013	170	0.141 ± 0.01	0.160 ± 0.01	0.301 ± 0.27	7.90 ± 0.10	0.024 ± 0.02

Tashkovski et al., (1968) determined an average daily milk productivity in Ovchepolian sheep of 0.46 l, comparing the average daily milk production per year. *Tokovski et al., (1988)* determined similar values of milk production, according to which it was 0.39 l and 0.38 l, respectively, in Merino sheep and Ovchepolian sheep. The differences in milk production identified in all years of measurements indicates a strong influence of feeding conditions upon milk production. In our examinations, lactation influenced ($P < 0.001$) all the examined factors significantly (Tab. 5). Average daily milk production in these sheep increased with age up to the third lactation, decreasing in the fourth and then maintaining its stability until the 7th lactation (Tab. 7). The highest expected daily milk production was identified in sheep in their third lactation (0.365 ± 0.26 l) and the lowest in sheep in their 7th lactation (0.255 ± 0.27 l). The percentage of milk fat was highest in sheep in the 7th lactation (7.90 ± 0.10%) and lowest in sheep in the third lactation (7.52 ± 0.10%). Analogous to total daily lactation, the amount of milk fat produced increased from the first to the third lactation, after which it decreased slightly.

Table 7. The influence of lactation on daily milk production in Ovchepolian sheep, LS-mean ± SE

Lactation	N	Morning (litres)	Evening (litres)	Total (litres)	Fat (%)	Fat (kg)
1	287	0.126 ± 0.01	0.140 ± 0.06	0.266 ± 0.28	7.87 ± 0.11	0.021 ± 0.02
2	480	0.132 ± 0.01	0.153 ± 0.06	0.285 ± 0.70	7.64 ± 0.10	0.022 ± 0.02
3	828	0.169 ± 0.01	0.196 ± 0.05	0.365 ± 0.26	7.52 ± 0.10	0.027 ± 0.02
4	833	0.153 ± 0.01	0.180 ± 0.05	0.333 ± 0.26	7.61 ± 0.10	0.025 ± 0.02
5	835	0.137 ± 0.01	0.158 ± 0.06	0.295 ± 0.27	7.72 ± 0.10	0.023 ± 0.02
6	691	0.124 ± 0.01	0.142 ± 0.05	0.266 ± 0.26	7.81 ± 0.10	0.021 ± 0.02
7	342	0.120 ± 0.01	0.135 ± 0.06	0.255 ± 0.27	7.90 ± 0.10	0.020 ± 0.02

In other breeds of sheep farmed in the Mediterranean area such as Massese, Laxta and Comisana sheep, all indigenous breeds of sheep *(Carnicella et al., 1989; Ruiz et al., 2000; Sevi et al., 2000)* determined an increase in milk production from the first to the third or fourth lactation. In the surveys of *Sevi et al., (2000)*, an increase in the amount of milk fat produced from the first to the third lactation was determined.

The lambing month also had a highly significant influence in relation to all factors examined (P < 0.001) (Tab. 5). A highly significant influence of this factor on daily milk production was also determined in another survey in Awassi sheep *(Pacinovski et al., 2014)*.

Analysing this factor, the highest daily milk production in the examined sheep population was recorded in the sheep lambed in March (0.306 ± 0.61), and the lowest in the sheep lambed in December (0.284 ± 0.23 l) (Tab. 8). It was the same with morning and evening milk. The sheep lambed in December had the highest percentage of milk fat (7.93 ± 0.10%), and the sheep lambed in March had the lowest (7.41 ± 0.23%). The amount of milk fat produced was about 0.023 kg per day for all lambing months. In the *Kastelic et al., (2013)* survey, a significant influence of the month or the season of lambing on milk production was also determined.

The month the milk was measured showed a highly significant influence (P < 0.001) in relation to almost all traits in the sheep population examined. This factor had no effect only on the percentage of milk fat (P > 0.05) (Tab.5).

Table 8. The influence of month of lambing on daily milk production in Ovchepolian sheep, LS-mean ± SE

Month of lambing	n	Morning (litres)	Evening (litres)	Total (litres)	Fat (%)	Fat (kg)
12	582	0.134 ± 0.01	0.150 ± 0.01	0.284 ± 0.23	7.93 ± 0.10	0.023 ± 0.02
1	2879	0.135 ± 0.01	0.157 ± 0.01	0.292 ± 0.22	7.77 ± 0.10	0.023 ± 0.02
2	630	0.138 ± 0.01	0.161 ± 0.01	0.299 ± 0.23	7.79 ± 0.10	0.023 ± 0.02
3	205	0.142 ± 0.11	0.164 ± 0.01	0.306 ± 0.61	7.41 ± 0.23	0.023 ± 0.04

Analysing the period from the 2nd to the 7th month of the milk control, the amount of milk decreased continuously in both the morning and evening milking and as a result the daily milk production per sheep also decreased. On the other hand, the percentage of milk fat increased continuously from February to July. This population achieved the largest amount of milk produced per head (0.026 ± 0.11 kg) in February, and the lowest in July (0.019 ± 0.10 kg) (Tab. 9).

Table 9. The influence of the month of milk recording on daily milk production in Ovchepolian sheep, LS-mean ± SE

Month of milk measurement	n	Morning (litres)	Evening (litres)	Total (litres)	Fat (%)	Fat (kg)
2	682	0.173 ± 0.03	0.191 ± 0.03	0.364 ± 1.56	7.31 ± 0.59	0.026 ± 0.11
3	722	0.160 ± 0.02	0.175 ± 0.02	0.335 ± 1.02	7.40 ± 0.39	0.025 ± 0.07
4	723	0.146 ± 0.01	0.161 ± 0.01	0.307 ± 0.50	7.52 ± 0.19	0.023 ± 0.04
5	723	0.131 ± 0.01	0.152 ± 0.01	0.283 ± 0.31	7.80 ± 0.12	0.022 ± 0.02
6	723	0.115 ± 0.01	0.141 ± 0.02	0.256 ± 0.74	7.98 ± 0.28	0.020 ± 0.05
7	723	0.100 ± 0.02	0.126 ± 0.03	0.226 ± 1.29	8.33 ± 0.49	0.019 ± 0.10

The number of milk recording had a highly significant influence ($P < 0.001$) on all parameters examined in Ovchepolian sheep (Tab. 5). A highly significant influence was also determined on the previous two factors (month and number of milk controls) in relation to all characteristics of daily milk production in similar surveys in Awassi sheep *(Pacinovski et al., 2014)*.

As for lactation, it increased up to the third or fourth milk control in the total and morning milk, and then decreased continuously until the sixth milk control (Tab. 10). In the evening milking, lactation increased up to the second milk control, after which it decreased until the last milk control.

The percentage of milk fat was the highest in the second milk control (7.81 ± 0.29%), and lowest in the fifth one (7.40 ± 0.39%). The amount of milk fat produced ranged from 0.020 ± 0.11 kg in the sixth to 0.024 in the second and fourth milk controls (Tab. 10).

Table 10. The influence of the number of milk recording on daily milk production in Ovchepolian sheep, LS-mean ± SE

Number of milk recording	N	Morning (litres)	Evening (litres)	Total (litres)	Fat (%)	Fat (kg)
1	723	0.132 ± 0.02	0.161 ± 0.03	0.293 ± 1.28	7.71 ± 0.49	0.023 ± 0.09
2	723	0.139 ± 0.01	0.169 ± 0.02	0.308 ± 0.75	7.81 ± 0.29	0.024 ± 0.05
3	724	0.141 ± 0.01	0.167 ± 0.01	0.308 ± 0.31	7.77 ± 0.12	0.023 ± 0.02
4	723	0.143 ± 0.01	0.163 ± 0.01	0.306 ± 0.50	7.70 ± 0.19	0.024 ± 0.04
5	722	0.138 ± 0.02	0.151 ± 0.02	0.289 ± 1.01	7.40 ± 0.39	0.021 ± 0.07
6	681	0.130 ± 0.03	0.137 ± 0.03	0.267 ± 1.56	7.63 ± 0.60	0.020 ± 0.11

The fertility or the number of lambs from individual sheep had no effect on any of the traits examined, with the exception of the total amount of milk, which manifested an effect on the level of $P < 0.01$ (Tab. 5).

In these sheep, a higher daily lactation (0.318 ± 0.15 l) was identified in those that had lambed 2 lambs compared with those who had only lambed one (0.313 ± 0.15 l) (Tab. 11).

Table 11. The influence of fertility on daily milk production in Ovchepolian sheep, LS-mean ± SE

Number of lambs	N	Morning (litres)	Evening (litres)	Total (litres)	Fat (%)	Fat (kg)
1	3362	0.149 ± 0.03	0.164 ± 0.01	0.313 ± 0.15	7.76 ± 0.56	0.024 ± 0.01
2	934	0.151 ± 0.03	0.167 ± 0.01	0.318 ± 0.15	7.76 ± 0.58	0.025 ± 0.01

The situation was identical with both morning and evening milk. The percentage of milk fat was the same for both groups of sheep (7.76%). Other authors, *Ruiz et al., (2000)* in Latxa sheep and *Pollot and Gootwine, (2004)* in Assaf sheep, found a significant influence of litter size on milk production. This factor also had a substandard influence on daily milk production in the survey of

Pacinovski et al., (2014) in Awassi sheep, where in relation to certain traits (evening and total amount of milk, daily production and milk fat) it had a significant influence ($P < 0.01$), while in relation to other traits (morning and afternoon milk, percentage of milk fat) it had no influence at all ($P > 0.05$).

Conclusion

The influence of many factors on daily milk production has been researched in Ovchepolian sheep as an indigenous sheep breed in the Republic of Macedonia.

The fact that the year had a highly significant influence ($P < 0.001$) in relation to all traits of annual milk production confirms that the diet must be given a great deal of attention in order to achieve higher milk production, excepting only selection as an important method of advancing genetic milk capacity. Commenting on the influence of lactation i.e. the age of specified traits, it is recommended not to keep animals in production for more than six lactations (7 years old) in this sheep population, except certain individuals that manifest above average milk production.

These females also need additional monitoring in order to serve as prospective ram mothers in further selection.

The average lactation (58 ± 0.247 l) and the determined minimal (27 l) and maximal (96 l) milk production in controlled heads, indicate the existence of large variations and the capacity to achieve significant success in selection in advancing the genetic capacity with the aim to produce milk, by implementing continuous and permanent selection.

Compared to the dairy sheep population in Europe and the world, which produces a significantly larger amount of milk annually and is more profitable from a visionary point of view, we can say that, genetically, Ovchepolian sheep have the potential to increase their milk productivity, but this requires a precise strategy that can predict every step of its realization. Therefore, and because it is an autochthonous breed of sheep that has been farmed on these areas for centuries, the Common European Policy (Cap-Common Agriculture Policy) provides protection for these breeds of sheep.

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Proizvodnja i sastav mleka autohtone rase ovaca u Makedoniji

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Rezime

Ispitivano je nekoliko proizvodnih svojstava (laktacijska proizvodnja mleka, proizvodnja mleka u dojnom periodu, proizvodnja mleka u muznom periodu, dužina dojnog perioda, dužina laktacije, proizvodnja mleka u toku jutarnje muže, proizvodnja mleka u toku večernje muže i dnevna proizvodnja mleka) kod ukupno 180 ovcepoljskih ovaca, u toku četiri proizvodne godine (2010-2013).

Uzrast ovaca bio je od prve do sedme laktacije, i kod njih je bilo realizovano ukupno 4319 individualnih laktacijskih kontrola. Osim bazične statistike, svi podaci su analizirani pomoću višefaktorijalnog fiksnog modela. Uticaj posebnih faktora ispitivan je pomocu F-testa, dok su analize uradjene pomoću programskog paketa SPSS.

Veći broj faktora (godina, laktacija, mesec jagnjenja i broj kontrole mleka), imali su visoko značajni uticaj ($P<0,001$), na dnevnu proizvodnju mleka (jutarnje, večernje i ukupno mleko, % mlečne masti i kg mlečne masti), kod ove rase ovaca. Mesec kontrole mleka u odnosu na sva svojstva imao je visoko značajni uticaj ($P<0,001$), osim na % mlečne masti ($P>0,05$). Jedino plodnost nije imala nikakav uticaj na varijacije ispitivanih parametara, osim na ukupnu dnevnu produkciju mleka, na koju je manifestovala visoko značajni uticaj ($P<0,001$).

Prosečna laktacijska mlečnost kod ispitivane populacije ovaca, sa sve četiri godine u proseku je bila 58 ± 0,247 l, dok je proizvodnja muznog mleka u istom periodu bila 37 ± 0,217 l. Dužina laktacijskog perioda u toku četiri ispitivane godine u proseku je bila 182 ± 0,31 dana.

Maksimalna dnevna mlečnost kod ove rase ovaca, izmerena je u toku 2011. godine (0,302 ± 0,26 l). U odnosu na starost, najveća dnevna mlečnost je utvrdjena kod ovaca u trećoj laktaciji (0,365 ± 0,26), a najniža u sedmoj laktaciji (0,255 ± 0,27).

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