Macedonian Journal of Animal Science, Vol. **10**, No. 1–2, pp. 5–9 (2020)
Article 269 In print ISSN 1857 – 6907
Received: Octoberr 15, 2020 On line ISSN 1857 – 7709
Accepted: December 14, 2020 UDC: 637.12'632/'638.054:547.495.2(497.2)

Original scientific paper

STUDY ON THE INFLUENCE OF CERTAIN FACTORS ON THE MILK UREA CONTENT IN SHEEP FROM THE BULGARIAN SYNTHETIC MILK POPULATION

Milena Mihaylova, Rumen Bazitov

Agricultural Institute, Stara Zagora, Bulgaria
milena_mihaylova_sz@abv.bg

A b s t r a c t: The concentration of milk urea (MU) can be used to evaluate crude protein in ration of sheep, which is particularly important for grazing animals whose assessment of intake is a major problem. Although the concentration of milk urea is mainly influenced by nutrients, its level could be influenced by some non-nutritional factors such as breed, season, pregnancy and stage of lactation, milkiness, milking time and somatic cell count. The aim of the study was to investigate the lactation stage and rainfall effects during the studied period on the average daily milk yield and milk urea level in sheep from the Bulgarian Synthetic Milk Population**.** The results from the current study show that the urea content of ewes' milk increases at the end of lactation ($P < 0.001$). During the active grass growth period there is an increase in milk urea level ($P < 0.001$). In early spring and autumn, as well as during periods with heavy rainfalls, sheep should be fed with high-quality cereal feed and simultaneously the level of nitrogen release to the environment should be monitored using milk urea level as indicator.It is highly imperative to develop appropriate nutrition strategies in order to provide the necessary nutrients for sustaining life and productivity, by using indicators of protein and energy levels, taking into consideration the impact of farming activities on the environment.

Key words: milk urea; ewes; stage of lactation; pasture

СТУДИЈА ЗА ВЛИЈАНИЕТО НА ОДРЕДЕНИ ФАКТОРИ ВРЗ СОДРЖИНАТА НА УРЕА ВО МЛЕКОТО ОД ОВЦИ ОД БУГАРСКАТА СИНТЕТИЧНА МЛЕЧНА ПОПУЛАЦИЈА

А п с т р а к т: Концентрацијата на уреата во млекото (MU) може да се користи за процена на застапеноста на суровиот протеин во исхраната на овците, што е особено важно за животните кои пасат, кај кои просепа на внесувањето протеини претставува голем проблем. Иако концентрацијата на уреа во млекото е главно под влијание на хранливи материи, нејзиното ниво може да биде под влијание и на некои нехранливи фактори како што се расата, сезоната, бременоста и фазата на лактација, млечноста, времето на молзење и бројот на соматски клетки. Целта на ова истражување беше да се испита влијанието на фазата на лактација и влијанието на периодот на врнежите врз просечниот дневен принос на млеко и врз нивото на уреа во млекото од овци од бугарската синтетична млечна популација. Резултатите од оваа студија покажуваат дека содржината на уреа во млекото се зголемила на крајот на лактацијата ($P < 0,001$). За време на периодот на активно растење на тревата се забележува зголемување на нивото на уреата во млекото ($P < 0,001$). Во раната пролет и наесен, како и за време на периодите со големи врнежи, овците треба да се хранат со висококвалитетна крмна смеска од житни култури и истовремено треба да се следи нивото на ослободувањето на азот во животната средина користејќи го нивото на уреата во млекото како индикатор. Многу е значајно да се развијат соодветни стратегии за исхраната, со цел да се обезбедат потребните хранливи материи и продуктивноста, со користење на индикатори за нивото на протеини и енергија, земајќи го предвид влијанието на земјоделските активности врз животната средина.

Клучни зборови: уреа во млеко, овци, фаза на лактација, пасење

INTRODUCTION

The reason for the rather low milk urea content may be due to the lack of crude protein in the ration (Ghavi Hossein-Zadeh and Ardalan, 2011). Although the concentration of milk urea is mainly influenced by nutrients, its level could be influenced by some non-nutritional factors such as breed, season, pregnancy and stage of lactation, milkiness, milking time and somatic cell count (Trevaskis and Fulkerson , 1999; Hojman et al., 2004; Jílek et al., 2006; Kuchtík et al., 2008; Bendelja et al., 2009; Ghavi Hossein-Zadeh and Ardalan, 2011).

Adequate balance between requirements and nutrient supplements is still a problem in feeding pasture ruminants. In Mediterranean pastures, protein excess is common in dairy sheep grazing in the vegetation phase. Under these conditions, grass grazing is rich in NPN and soluble proteins, while it is often relatively poor in carbohydrates without structural fibers (Molle et al., 2007). Excess protein and uneven degradability of proteins and carbohydrates in the rumen result in increased ammonia absorbtion from its wall. This in turn leads to an additional consumption of energy for detoxification of ammonia in the liver, an increase in urea in the blood and milk, and consequently greater losses of N, especially through urine. Sustainable pasture systems often cover the usage of forage legumes to reduce the import of fertilizers. The involvement of legumes with a high proportion in the diet of sheep can increase the imbalance between energy and protein and thus increase N release into the environment (Molle et al., 2009).

The aim of the study was to investigate the lactation stage and rainfall effects during the studied period on the average daily milk yield and milk urea level in sheep from the Bulgarian Synthetic Milk Population..

MATERIALS AND METHODS

The study included sheep-mothers of the Bulgarian Synthetic Milk Population from the herd of the Agricultural Institute – Stara Zagora. Monthly controls for the months of April, May and June in three consecutive years – 2015, 2016 and 2017 – were tracked.

In April 2015 the sheep received a ration consisting of 0.65 kg of concentrate with 14% CP, 0.1 kg of wheat grain, 2 kg of barley haylage and pasture. In May, sheep received 0.75 kg of concentrate in addition to pasture and in June 0.44 kg of concentrate, 0.5 kg of beer mash and pasture. The concentrate mix consists of corn, well-shelled sunflower meal, mineral and vitamin premix, limestone and cooking salt. The 1 kg dry substance of the mixture contains 1.22 FUM, 138 g CP, 98 g PDI, 4.5 g PBR, 10 g Ca and 6.6 g P. The composition of the concentrate mixture is the same for the three years of the study (Table 1). In 2016 and 2017, the rations of the sheep were identical, with maize silage in milky-waxy maturity stage being provided instead of barley. The protein and energy values of the concentrate mixture were calculated by Todorov (2007).

Milk productivity was monitored monthly at 30 days intervals during the morning milking. Milk samples were taken individually for each animal and analyzed for urea content according to the methodology described by Angelov, Ibrishimov and Milashki (1999).

For a more detailed study on the rainfall effect on pasture, fallen precipitation monitoring was divided into ten-day periods, the data from which were used for the months of April, May and June for 2015, 2016 and 2017.

Statistical processing of the results was performed with the SYSTAT for Windows software.

Table 1

Protein and energy value of concentrate mixture – per 1 kg

Ingredients	Quantity kg	Dry matter kg	Feed units for milk (FUM)	Crude protein g	Protein digestible in the intestine (PDI), g	Protein balance in the rumen (PBR), g
Corn	0.765	0.66	1.033	68.1	71.9	–27.5
Well-shelled sunflower meal	0.2	0.174	0.186	70.0	26.0	32.0
Креда limestone	0.025	0.023				
Salt	0.005	0.005				
Premix	0.005	0.005				
Total	1.000	0.867	1.219	138.1	97.9	4.5

RESULTS AND DISCUSSION

The results from the conducted study are presented in Table 2. A decrease in average daily milk production was estimated in May, compared to the control in April in the three years, and in June, compared to the level in May. The average daily milk yield had the following values: 0.77 kg, 0.73 kg and 0.7 kg, respectively, for the three months of 2015. In 2016, an average milk production of the ewes sheep group of 0.82 kg, 0.77 kg and 0.74 kg, respectively, was reported for the months of April, May and June. For 2017, relatively constant values are observed. A similar decrease in lactation in sheep with advancing lactation was found by other authors (Pavić, 2002; J. Kuchtík et al., 2008).

Table 2

Average daily milk yield (kg) and milk urea, mg/dl

Year	April					May					June				
	Average daily milk yield			Milk urea		Average daily milk yield			Milk urea		Average daily milk yield			Milk urea	
	kg			mg/dl		kg			mg/dl		kg			mg/dl	
	n	x ± SE	CV	x ± SE	CV	n	x ± SE	CV	x ± SE	CV	n	x ± SE	CV	x ± SE	CV
2015	27	0.77±42.5	0.3	14.0±0.7*	0.3	28	0.73±48.9	0.4	18.6±0.5^{A}	0.1	19	0.70±93.3	0.6	19.5±0.9*^{B}	0.2
2016	22	0.82±46.3	0.3	14.3±0.3*	0.3	25	0.77±52.0	0.3	21.8±0.5^{A}	0.1	17	0.74±100	0.6	21.3±0.9*^{B}	0.7
2017	22	0.74±33.4	0.2	14.2±0.7*	0.2	22	0.78±56.0	0.3	19.8±0.5^{A}	0.1	16	0.74±107	0.6	19.3±1.0*^{B}	0.2

* The differences are significant at P < 0.0001. A, B – The differences are significant at P < 0.001

In the earlier stages of lactation, the urea content of sheep's milk is lower than at the end of lactation. During the control in April 2015 the value measured was 14.0 mg/dl. In the next two measurements – May-June, levels were increased to 18.6 and 19.5 mg/dl. The differences were significant at P < 0.0001 between the April-May values and at P < 0.001 between the April-June values. Similar levels of urea were also measured in 2016 – in April, the urea content was 14.3 mg/dl, in May it was 21.8 mg/dl and in June it was 21.3 mg/dl. The differences between the April-May and May-June values at P < 0.001 were established.

The amount of milk urea increased from April to June and in 2017. Values of 14.2 mg/dl, 19.8 mg/dl and 19.3 mg/dl were measured for the respective controls in April, May and June. The differences were the same as in the previous year. Along with the lactation stage progress, a similar trend was established by other authors (Velazquez, 2000; Matutinović et al., 2014).

Considering the data from the fallen precipitation (mm) in Stara Zagora district for the relevant study periods, we could draw a conclusion about their impact on the quantity and quality of pasture consumed from animals, which is less on the total milk quantity and more tangible on the level of urea in milk.

The data on precipitation are given in Table 3. The level of fallen precipitation and the stock of soil with moisture from previous periods affect the growth rate and the amount of pasture grass. In this sense, the relationship between precipitation and urea levels in milk can be considered after about 10 – 14 days. In general, higher values of urea in milk were observed in 2016, when precipitation was more abundant during the period of our observation.

Fresh grass, grown after heavy rainfall, contains a greater amount of nitrogenous substances, which under equal other conditions (the presence of energy in the ration) are released through body fluids and milk in the form of urea. In this case, however, this release is within normal values and could not have a negative impact on health and productivity of the animals.

Since it is difficult to control the amount of grass consumed from sheep, milk urea level could serve as a guiding tool for farmers to estimate whether there is sufficient energy in the ration to convert nitrogen from green grass into microbial protein. An appropriate amount of energy supplement (in most cases a grain component) should be selected in order to utilize easily digestible and inexpensive protein sources according to the daily milkiness level and the lactation stage. Insufficient

attention is paid to the botanical composition of pastures in terms of diet optimization to ensure optimal protein and energy amounts and their proper ratio. Studies by some authors have resulted in recommendations regarding the usage of more legumes in pasture grass composition to provide essential nutrients and protect the environment by reducing nitrogen excretion with the urine (Molle et al., 2009).

The semi-extensive farming systems are strongly affected by climate and environmental conditions, especially precipitation which is directly related to the quantity and quality of pasture. According to that, a significant effect of year and seasonal variation on nitrogen components of sheep milk in sub-Mediterranean area was detected. The mentionned farming conditions determine the variation in digestibility of protein and carbohydrates from pasture forage. According to milk composition and nitrogen components, a requirement to add feed supplements into the animal diet should be taken into consideration. Also an appropriate management practices and control of diet to reduce the effects of year and seasonal variations should be implemented (Matutinović et al., 2014).

Table 3

Fallen precipitation by ten days for the period 2015 – 2017 (mm)

Year	2015								
Months	March			April			May		
Ten days period	I	II	III	I	II	III	I	II	III
Fallen precipitation, mm	8.8	20.2	35.8	20.6	–	4.6	17.5	8.8	34.8
Year	2016								
Months	March			April			May		
Ten days period	I	II	III	I	II	III	I	II	III
Fallen precipitation, mm	16	33	39	–	18,5	24,4	61	10	82
Year	2017								
Months	March			April			May		
Ten days period	I	II	III	I	II	III	I	II	III
Fallen precipitation, mm	–	42	29	11	31.6	–	30.5	10	40

CONCLUSIONS

The results from the current study show that the urea content of ewes' milk increases at the end of lactation ($P < 0.001$). During the active grass growth period there is an increase in milk urea level ($P < 0.001$).

In early spring and autumn, as well as during periods with heavy rainfalls, sheep should be fed with high-quality cereal feed and simultaneously the level of nitrogen release to the environment should be monitored using milk urea level as indicator.

It is highly imperative to develop appropriate nutrition strategies in order to provide the necessary nutrients for sustaining life and productivity, by using indicators of protein and energy levels, taking into consideration the impact of farming activities on the environment.

REFERENCES

Angelov, G., Ibrishimov, N., Milashki, S.: *Clinical Laboratory Studies in Veterinary Medicine*. Sofia, 1999..

Bendelja, D., Antunac, N., Mikulec, N., Vnučec, I., Mašek, T., Mikulec, Ž., Havránek, J.: Urea concentration in sheep's milk. *Mljekarstvo* **59** (1) 3–10 (2009).

Cannas, A., Pes, A., Mancuso, R., Vodret, B., Nudda, A.: Effect of dietary energy and protein concentration on the concentration of milk urea nitrogen in dairy ewes. *Journal of Dairy Science* **81** (2), 499–508 (1998).

Ghavi Hossein-Zadeh, N., Ardalan M.: Estimation of genetic parameters for milk urea nitrogen and its relationship with milk constituents in Iranian Holsteins. *Livestock Science* **135** (2–3), 274–281 (2011).

Hojman, D., Kroll, O., Adin, G., Gips, M., Hanochi, B., Ezra, E.: Relationships between milk urea and production, nutrition, and fertility traits in Israeli dairy herds. *Journal of Dairy Science* **87** (4), 1001–1011 (2004).

Jílek, F., Řehák, D., Volek, J., Štipková, M., Němcová, E., Fiedlerová, M., Rajmon, R., Švestková, D.: Effect of herd, parity, stage of lactation and milk yield on urea concentration in milk. *Czech Journal of Animal Science* **51** (12), 510–517 (2006).

Kuchtík, J., Šustová, K., Urban, T., Zapletal, D.: Effect of stage of lactation on milk composition, its properties and the quality of rennet curdling in East Friesian ewes. *Czech Journal of Animal Science* **53** (2), 55–63 (2008).

Matutinović S., Salajpal K., Kalit S.: Variation in nitrogen components of sheep milk in sub-Mediterranean area. *Mljekarstvo* **64** (1), 27–33 (2014).

Molle, G., Decandia, M., Fois, N., Ligios, S., Cabiddu, Sitzia M.: The performans of Mediterranean dairy sheep given acces to sulla (*Hedysarum coronarium* L.) and annual ryegrass (*Lolium rigidum* Gaudin) pastures in different time proportions. *Small Ruminant Research* **49** (3), 319–328 (2003).

Molle, G., Cabiddu, A., Decandia, M.: Re-visiting the nutrition of dairy sheep grazing Mediterranean pastures. *Italian Journal of Animal Science* **6** (1), 235–243 (2007).

Molle, G., Giovanetti, V., Cabiddu, A., Cuccureddu, M., Scanu, G., Decandia, M.: Milk urea as nutritional indicator in sheep grazing legume-based pastures. *Options Mèditerranèennes*, Series A, no: 85, *Nutritional and foraging ecology of sheep and goats*. 141–146 (2009).

Pavić, V., Mioć, B., Neven, A., Ivanković, A.: Influence of stage of lactation on the chemical composition and physical properties of sheep milk . *Czech J. Anim. Sci*., **47** (2), 80–84 (2002).

Todorov, N.: *A Guide to Animal Nutrition*. Matkom. Sofia, 2007.

Totty, V. K., Greenwood, S. L., Bryant, R. H., Edwards, G. R.: Nitrogen partitioning and milk production of dairy cows grazing simple and diverse pastures. *Journal of Dairy Science* **96** (1), 141–149 (2013).

Trevaskis, L. M., Fulkerson, W. J.: The relationship between various animal and management factors and milk urea, and its association with reproductive performance of dairy cows grazing pasture. *Livestock Production Science* **57** (3), 255–265 (1999).

Velazquez, M.: *Udder health and milk composition, with special reference to beef cows*. A literature review. Swedish University of Agricultural Sciences, Skara. 1–52, 2000.