ENERGY AND PROTEIN CONTENT IN THE DIET AND RELATIONSHIP WITH MILK UREA IN SHEEP FROM THE SYNTHETIC POPULATION BULGARIAN DAIRY

Milena Mihaylova

Agricultural Institute – Stara Zagora, milena_mihaylova_sz@abv.bg

Abstract

The aim of the study was to investigate the relationship between energy and protein content in the diet as well as the level of urea in sheep from the Synthetic Bulgarian Dairy population.

The study included 24 sheep of the breed Synthetic population Bulgarian dairy from the herd of the Agricultural Institute - Stara Zagora in 2017. Monthly controls were performed and samples were taken for analysis in April, May and June.

Energy intake (feed units per milk - FUM) and crude protein with ration (CP) were - for April - 2.0 FUM and 241.8g CP, for May - 1.9 FUM and 258.6 g CP and for the month of June - 1.72 FUM and 231.3 CP. Sampling was performed during the morning milking of the sheep at 30-day intervals. Milk samples were tested immediately for urea concentration in the milk. The urea content was determined by the method described by Angelov, Ibrishimov, Milashki (1999), based on the urease method with the Conway cup. The statistical processing of the obtained results was performed with the program STATISTICA for Windows.

The following conclusions can be drawn from the study:

The urea content in milk increases with increasing concentration of crude protein in the ration. In the presence of higher amount of energy in the ration, more degraded ammonia can be processed into microbial protein, which leads to more efficient usage of protein than feed. At a FUM / CP ratio in the ration of 120.9 for the month of April, the level of urea in the milk is 15.6 mg / dl. For the months of May and June milk urea was - 136.1 and 134.5, and the levels of urea in milk was expectedly close - 21.8 and 21.9 mg / dl.

Key words: *milk urea, sheep, protein*

Blood urea concentration and milk urea concentration are used as nutritional indicators in ruminants, since they are closely related to the activity of the digestive tract and endogenous ammonia production. Urea is the major end product of nitrogen metabolism in ruminants. The urea content in blood and milk is highly related to nitrogen excretion (Nousianen, 2004; Zhai, 2005). Blood urea levels cannot be measured routinely, because sampling requires invasive techniques and concentrations and may change rapidly after feeding. Urea in milk is a more solid and easier to sample indicator than concentration of urea in blood (Jelinek, 1996; Khaled, 1999; Pazzola, 2011). In dairy cows, there are several studies demonstrating that the concentration of urea in milk is related to the intake of dietary crude protein, the amount of degradable and non-degradable protein in the stomach and the protein / energy ratio in the diet (Butler, 1996; Oltner, 1983).

In dairy sheep fed with diets having a crude protein concentration of 14% to 21% in the dry matter, the level of urea in the milk is positively and linearly related to the dietary protein content and to a lesser extent to the protein intake (Cannas, 1998; Giovanetti, 2019).

Ascertaining the relationship between the indicators of the diet and urea content in milk is important for controlling the technological properties of milk. In sheep and goats, milk is most often processed into yoghurt products. A number of authors have studied the negative impact of

high levels of urea in milk on its processing into cheese (Coulon, 1998; Pirisi, 2001; Mioc, 2002; Claire, 2004; Matutinovic, 2014).

The aim of the current study was to investigate the relationship between energy content and protein content in the diet and milk urea levels in sheep from the Synthetic Bulgarian Dairy population.

Material and methods

The study included 24 sheep of the breed Synthetic population Bulgarian dairy from the herd of the Agricultural Institute - Stara Zagora in 2017. Monthly controls were performed and samples were taken for analysis in April, May and June.

The composition of the diet is presented in Table 1.

April - 0.65 kg of concentrated mixture, pasture, 2 kg of maize silage
May - 0.75 kg of concentrated mixture, pasture
June - 0.44 kg concentrated mixture, grazing, 0.5 kg of fresh beer porridge

The concentrated mixture contained: maize grain - 76.5%, sunflower oil meal - 20%, limestone - 2.5%, salt - 0.5% and vitamin-mineral premix for sheep - 0.5%.

The energy intake (feed units per milk - FUM) and crude protein with the diet (CP) were as follows - for the month of April - 2.0 FUM and 241.8g CP, for the month of May - 1.9 FUM and 258.6 g CP and for the month of June - 1.72 FUM and 231.3 CP. Sampling was performed during the morning milking of the sheep at 30-day intervals. Milk samples were tested immediately for urea concentration in the milk. The urea content was determined by the method described by Angelov, Ibrishimov, Milashki (1999), based on the urease method with the Conway cup.

The statistical processing of the obtained results was performed with the program STATISTICA for Windows.

Results and discussion

The results of the study are presented in Table 2.

Table 2. Energy and protein value of rations and concentrate mixture

Diets	**DM,kg**	**FUM**	**CP,g**	**PDI,g**	**PBR,g**
April	**1.8**	**2.0**	**241.8**	**160**	**6.9**
May	**1.7**	**1.9**	**258.6**	**169**	**8.3**
June	**1.6**	**1.72**	**231.3**	**170**	**-15**
In 1 kg concentrate	**DM,kg**	**FUM**	**CP,g**	**PDI,g**	**PBR,g**
	0.873	**1.219**	**138.1**	**98**	**4.5**

where: DM – dry matter; FUM – forage units per milk, CP – crude protein; PDI – protein digestible in the intestine; PBR – protein balance in the rumen

The table shows that the consumed amount of crude protein with the diet is highest in May - 258.6 g. The energy in the diet, expressed in FUM, is respectively 2 FUM for the month of April, 1.9 FUM for the month of May - 1.72 FUM for the month of June.

The established levels of average daily milk yield and urea content in milk are presented in Table 3.

Table 3. Average daily milk yield, concentration of CP in the diet and urea content in milk

Months	Ewes, n	Average daily milk yield x ± SD	CP, % of DM in diet	CP/FUM	Milk urea, mg/dl x ± SD
April	**24**	**0,887 ± 192**	**13,4**	**120,9**	**15,6 ± 3,5^{A,B}**
May	**24**	**0,924 ± 170**	**15,2**	**136,1**	**21,8 ± 2,2^{A}**
June	**20**	**0,836 ± 340**	**14,5**	**134,5**	**21,9 ± 3,7^{B}**

Differences are statistically reliable at P <0.001 when letters after the average values are different

The average daily milk yield at the first sentinel group in April was 0.887 kg. This was followed by an increase to 0.924 kg in May, and for June it is 0.836 kg. The differences between the groups are statistically insignificant.

The concentration of crude protein in the ration of ewes as a percentage of the dry matter of the ration is 13.4% for April, 15.2% for May and 14.5% for June. The measured levels of urea in the milk correspond better to the ratio of crude protein to energy in the ration than to the concentration of crude protein or the amount of crude protein received with the ration. For the month of April, the ratio between crude protein and energy is 120.9 g of crude protein per FUM. This ratio results in 15.6 mg / dl of urea in the milk. For the month of May, the ratio is 136.1 g of crude protein in the ration of one FUM. This level correlates with a urea concentration in milk of 21.8 mg / dl. For the month of June, 134.5 g of crude protein was taken into the ration of one FUM, and the content of urea in the milk was 21.9 mg / dl. The similar levels of urea in the milk for the controls in May and June are related to similar amounts of crude protein intake per FUM in the ration. This confirms the findings of other studies, according to which the available energy in the stomach is crucial for optimal utilization of protein degraded to ammonia.

According to Giovanetti V. (2019), the level of urea in milk is not related to the ration content of CP. due to the highly low range of CP variation, but rather to the ratio between CP and energy in the ration. The suitability of usage of the CP / NEL ratio, as well as the predictions for urea content in milk, was confirmed after meta-analyzes of an extended database.

Further studies are needed on the effect of the ratio between soluble and structural carbohydrates in the ration on the effect on urea levels in milk. It, in turn, will make it possible to predict the use of ammonia in the stomach as a complete microbial protein.

Conclusions

The following conclusions can be drawn from the study:

The urea content in milk increases with increasing concentration of crude protein in the ration. In the presence of higher amount of energy in the ration, more degraded ammonia can be processed into microbial protein, which leads to more efficient use of protein than feed.

At a FUM / CP ratio in the ration of 120.9 for the month of April, the level of urea in the milk was 15.6 mg / dl. For the months of May and June milk urea was - 136.1 and 134.5, and the levels of urea in milk were expectedly close - 21.8 and 21.9 mg / dl.

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