

Calcium, Phosphorus and Magnesium in The Blood Serum of Cows Fed on Silage

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Abstract

The amount of calcium, phosphorus and magnesium in milking cows' blood was tested and it is one of indicators cows were fed with these substances. The average amount of calcium in tested cows' blood is 12.35 mg/100 ml serum, the average amount of phosphorus is 5.45 mg/100 ml and the average amount of magnesium is 3.25 mg/100 ml.

Keywords: Cow; Calcium; Phosphorus; Magnesium

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Introduction

The amount of these mineral substance in latge content of fodder all over our is not tested enough. Last research results of mineral substance in the fodder show the low level of phosphorus that appears more often than calcium does. The manifestation appears more often during the drought and during some periods that occurs very often at Kosovo and Metohija and where the tests were performed. It should be mentioned the fact that the soil Kosovo and Metohija contains a low level of physiologically active phosphorus (P_2O_5), as Miric (1999) established and the low of this element in soil has an adverse affect on the level of this element in plants. It should be mentioned Stojkovic's observation that lots of plants from this area contain the low level of phosphorus. Examinations of the level of calcium, phosphorus and magnesium in cow's blood serum which are fed by different fodder as a source of these elements and standard fodder with mineral would certainly contribute to better knowingness of general status and dynamics circulation of these elements and their relations in cows' blood serum. They assumed that their level in blood serum is one of the indicators that cows fed with these elements. Contribution is certainly greater since the cows with different lactation were examined.

Material and Methods

The experiments were carried out on Simmental cows at the farm. It lasted 45 days during which the blood samples were taken for the mineral analyses. There were 20 cows and five of them were at the beginning of the lactation period with average 25 kg of milk per day (first group). In the second group there were five cows in the middle of lactation period with average 22.5 kg of milk per day. In the third group there were five cows at the end of lactation period with average 12.6 kg of milk per day and in fifth group were pregnant cows.

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They were fed with 4.0 kg of alfalfa hay, 25.0 kg of maize silage, while the fodder for the milking cows was distributed by groups : cows at the beginning of lactation 5 kg, cows in the middle of lactation 4 kg, and those at the end of lactation and pregnant cows 3 kg. Structure and nutrition value of cow' servings are showed in the table 1 and chemical composition, nutritious value and mineral composition in table 2.

| Group | Food | kg | S.M. (kg) | H.J. | S.P. (g) | Ca (g) | P (g) | Mg (g) |
|-------|--------------|-------|-----------|------|----------|--------|-------|--------|
| I | Hay lucerne | 4,0 | 3,64 | 1,82 | 337 | 41,0 | 13,8 | 2,90 |
| | Maize silage | 25,0 | 7,50 | 7,20 | 520 | 127,0 | 45,3 | 11,8 |
| | Fodder | 5,0 | 4,55 | 5,60 | 587 | 75,0 | 51,9 | 4,60 |
| | Total | 15,69 | 14,62 | 1444 | 243,0 | 111 | 19,0 | |
| II | Hay lucerne | 4,0 | 3,64 | 1,82 | 335 | 41,0 | 13,8 | 2,95 |
| | Maize silage | 25,0 | 7,50 | 7,0 | 495 | 130,0 | 45,3 | 11,89 |
| | Fodder | 4,0 | 3,50 | 4,85 | 470 | 61,2 | 37,6 | 3,80 |
| | Total | 14,64 | 13,66 | 1300 | 232,2 | 96,7 | 18,64 | |
| III | Hay lucerne | 4,0 | 3,64 | 1,82 | 337 | 41,0 | 13,8 | 2,90 |
| | Maize silage | 25,0 | 7,50 | 7,0 | 495 | 130,0 | 45,3 | 11,70 |
| | Fodder | 3,0 | 2,66 | 4,10 | 380 | 52,2 | 28,9 | 3,15 |
| | Total | 13,90 | 12,68 | 1223 | 226,4 | 89,15 | 17,87 | |

Table 1: Composition and nutritious value of serving.

The level of calcium, phosphorus and magnesium in cows' blood and food they were fed with is tested. Cows' blood was taken v. jugularis and the serum was isolated and tested to these metals. Calcium in the samples of fodder was tested by permanganate method. Serum samples were tested by atomic - absorbing methods, the hollow cathode HCL at 442,7 nanometre wave lenght. Phosphorus in the fodder samples was tested by classical gravimetical methods, measured as $M_{g_2}P_2O_7$ and serum samples by colourmetrical methods on photocolourmetre. Magnesium in the fodder samples was tested by gravimetical method as M_gO , and serum on atomic absorber.

| Food | Hay lucerne | Maize silage | Fodder |
|-------------|-------------|--------------|--------|
| Moisture % | 9,60 | 69,45 | 11,28 |
| Ash % | 6,25 | 3,61 | 6,45 |
| Proteins % | 16,00 | 4,29 | 12,60 |
| Cellulose % | 31,25 | 7,79 | 5,87 |
| Fat % | 3,75 | 0,34 | 3,50 |
| BEM % | 33,94 | 16,87 | 60,70 |
| Ca (g) | 13,70 | 5,20 | 13,90 |
| P (g) | 4,50 | 1,80 | 6,83 |
| Mg (g) | 0,95 | 2,0 | 1,10 |
| S.P. (g) | 1,10 | 1,98 | 11, 50 |
| H.J | 0,45 | 0,28 | 1,10 |

Table 2: Chemical composition and nutritious value of used foodstuff.

Statistical analysis of data is done by Statistica programme version 6, Stat Soft. Inc. (2003).

Research Results and Discussion

The amounts of calcium, phosphorus and magnesium, measured in the experiments, are in table 3 and 4.

The average amount of calcium in cows' blood serum in the experiment is 12.35 mg/100 ml serum (table 4). That amount was within the normal limits. The amount of calcium in fodder was sufficient to provide enough calcium in the blood serum (224-242).

The average amount of phosphorus for all groups in the experiment is 5.45 mg/ 100 ml. serum. This result is on the lower level within the normal scale amount on literature data (4.5-6.5 mg/100 ml). Observing apart the amounts of the content it can be seen that 9 out of 20 cows had amount of phosphorus under the lower limit of normal content. So it can be concluded that there was not enough phosphorus in the foodstuff.

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Since it was established that there was enough amount of phosphorus in the fodder, it is possible that other factors influenced to the low amount in the blood serum among which it should be mentioned first of all the level of usage out of some kind of fodder.

Based on the mineral elements' analysis, it is concluded that amount of calcium and phosphorus are directly connected to cows' lactation. The group of cows with average daily lactation of 25.0 kg had the lowest amount of calcium and the pregnant cows had the highest amount. The proportion was 10.52 : 12.40 mg/100 ml serum (table 3).

The amount of magnesium was within the normal limits (3.25 mg/100 ml) and there were slight changes among groups and among cows. There were no individual changes in the amount of magnesium nor there were changes within the group of cows with different lactation. But groups' average amounts indicated that magnesium is not in the same relations to lactation as calcium and phosphorus are. It means that the cows with highest lactation had the highest amount of magnesium and vice versa. The difference between the lowest and the highest amount was 9%, in the favor of the highest amount.

| Group | Mineral matters | X |
|-------|-----------------|-------|
| I | Ca | 10,52 |
| | P | 4,08 |
| | Mg | 3,20 |
| II | Ca | 11,65 |
| | P | 4,81 |
| | Mg | 3,18 |
| III | Ca | 10,85 |
| | P | 5,60 |
| | Mg | 3,12 |
| IV | Ca | 12,40 |
| | P | 6,10 |
| | Mg | 3,10 |

Table 3: Content of calcium, phosphorus and magnesium in blood serum of investigated cows (mg/100 ml).

Judging by data from the book *Underwood* (1972, 1976), *Mirica* (1999), this amount was 8.66% lower from the average amount of calcium in the previous experiments *Stojkovic* (2006, 2015). Based on same data the amount of calcium in the blood serum milking cows can be considerably higher, *Vijculata., et al.* (1983) which was the case when high amounts of calcium were added to their servings. There are also cases with extremely low amounts of calcium. As *Lalov., et al.* (1976) mentioned in his experiments the amount of calcium was just 4.47 mg in 100 ml with the very high amount of phosphorus (15.67 mg/100) at the same time.

| Element | X | S | CV | IV |
|---------|-------|------|-------|------------|
| Ca | 12,35 | 2,71 | 11,30 | 8,97-13,17 |
| P | 5,45 | 2,50 | 18,90 | 3,68-7,12 |
| Mg | 3,25 | 2,10 | 8,90 | 2,10-3,62 |

Table 4: The content of calcium, phosphorus and magnesium in the cows' blood serum, average amount for all groups.

X = Arithmetic mean,

S = Standard deviation,

CV = Coefficient of variation,

IV = Interval of variation

The amount of phosphorus changed in the relation to cows' lactation. The group of cows with average daily lactation of 25.00 kg had the lowest amount of phosphorus in the blood serum which was 4.08 mg/100 ml serum (table 3). These amounts were under the lower limits of normal amounts and also insufficient amount for the organism. The amount of phosphorus was increasing in the group of cows with lower lactation. In the group of cows with average daily lactation of 22.50 kg the amount of phosphorus was 4.81 mg/100 ml and that was above lower level of the normal amounts. This amount was even more increased (5.60 mg in 100 ml) with the group of cows with average daily lactation of 12.60 kg and even more (6.10 mg/100 ml, table 3) with the group of pregnant cows.

In the experiment with milking cows *Miric., et al.* (1994) established that the of phosphorus in the blood serum in is correlation with lactation which *Stojkovic* (2003, 2006) results confirmed. The amount of phosphorus in *Stojkovic's* previous testing was 5% lower than in this. The fact that amount of phosphorus in the blood serum can be above the average (4.5–6.5 mg/100 ml) confirms the experiments of *Underwoodu* (1972, 1976) and *Haraka., et al.* (1996) where the pregnant heifers had from 6.92 to 7.8 mg/100 ml phosphorus. The amount of phosphorus was even greater (9.94 – 10.40 mg/100 ml) in the experiments of *Seidela., et al.* (1970).

Undrrwoodu (1976) and *Obracevic* (1973) explained that there were slight changes in the amount of magnesium because magnesium doesn't decrease in the soft tissues even when skeleton lost 30% of magnesium. The results of experiments showed certain correlation between the amount of calcium and phosphorus and lactation. The cows with high lactation had lower amounts of these elements and vice versa. This fact was established even when these elements were not examined or showed a deficit. This manifestation was evident in the variations in the amount of phosphorus and little less evident in the amount of calcium while the amount of magnesium behaved differently.

Conclusion

The levels of calcium, magnesium and phosphorus in the blood serum were tested, as one of the indicators that the cows are fed with these elements.

The results of the experiments are

1. The average amount of calcium in the blood serum is 12.35 mg/100 ml of serum, of phosphorus is 5.45 mg/100 ml and magnesium 3.25 mg/100 ml. The amounts of calcium were on the upper level of normal amounts gotten from books while the amount of phosphorus was almost deficient.

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2. The amounts of calcium and phosphours were decreasing during the period of high lactation while the cows with low lactation had these amounts increased. Calcium varies from 10.52 to 12.40 and phosphorus varies from 4.08 to 6.10 mg in 100 ml of serum.
3. The amounts of magnesium didn't change much in relations to cows' lactation but magnesium behaved differently from calcium and phosphorus.

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