


<b>Subacute Rumen Acidosis in After Calving Period And Laminitis in Cattle</b>			<b>Veterinary Medicine</b>
		<b>Keywords:</b> ruminal pH, glucose, calcium, phosphorus, acidosis, lameness.	
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### Abstract

From October 2011 - December 2012 two groups of 20 heads of cattles with experimentally attended screenings halting syndrome was affected by the condition of subacute rumen acidosis. Various food rations taking into account differences of acid and base equivalentents were used in these groups of animanl. Animals of the first group were treated with food rations in dominance of acid equivalentents and with acid base difference equivalent to - 12:35. The second group of animals was treated with food rations in dominance of basic equivalent with the difference of acid-base equal 137.13. Animals of both groups were checked during the first four months after calving for rumen pH, glucose level, total calcium and inorganic phosphorus in the blood. In the first group of cows in experiment with ruminal acidosis (rumen pH average for the study period,  $5.51 \pm 0.3$ ), with the average level of glucose in  $0:03 \pm 1.87$  mmol / liter, the overall calcium average  $\pm 7.71$  mg% 00:11 and inorganic phosphorus on average  $5.83 \pm 0:02$  mg% in the first four months of after calving, halting syndrome was detected in six heads or in 30.0%. In the second group of cows, with normal rate of levels for rumen pH ( $5.92 \pm 0.7$ ), average glucose  $2:12 \pm 0:02$  mmol / liter, the average of total calcium  $9:24 \pm 0:09$  mg% and inorganic phosphorus average  $6:12 \pm 0:04$  mg%), halting syndrome was observed in one cow or in 5.0%. The data obtained for rumen pH, glucose level, total calcium and inorganic phosphorus in the two groups of cows and in cows affected by halting syndrome were confirmed statistically ( $P > 0.99$ ). Rumen pH, glucose and calcium level present correlative links and negative character ( $r = - 0.428$ ,  $r = - 0.686$  and  $r = - 0.791$ ) by halting syndrome from laminitis in cattle and inorganic phosphorus level is about dependency positive character ( $r = 0.629$ ).

### Introduction

Halting syndrome in cows is a clinical manifestation of aseptic laminitis is more frequent in the period up to four months after calving. Conceptually, aseptic laminitis represents inflammation of lamellar corium in the wall of the heels which could spread to the solar surface (Clakson M.L., 2006; Mortensen, 1999). In the causation of this process remains numerous factors related to breeding conditions and disorders especially in animal nutrition. Significant impact presents condition of subacute rumen acidosis. The feeding of cows for milk production in early lactation period, with foods that contain high levels of acid equivalentents, creates the possibility for the subacute rumen acidosis condition, accompanied by reduction in synchronous systems metabolites of basic in buffer systems. This condition is associated with decrease in body weight, decreased milk production, disorders of reproduction indicators and increased incidence of laminitis manifested by lameness syndrome (Ceroni V. e bp., 2005). Checking the condition of the rumen acidosis can be achieved with pH assessment of its content, the status of glucose level, total calcium and inorganic phosphorus in the blood. According to Manson F. J. (2001), in individuals who present depressed levels of pH in the rumen content, hypoglycemic condition, hypocalcemic and relative increase of inorganic phosphorus level in the blood for a relatively long time after calving, has more increased the opportunities to experience the lameness syndrome.

Based on the high level of laminitis syndrome in cows and from the above considerations, the study was undertaken to identify the relation between the difference of acid-base equivalents of dietary, pH of rumen content, glucose, total calcium and the inorganic phosphorus with laminitis syndrome in cows. The study is intended to demonstrate experimentally the relation of factors and to contribute in terms of clinical practice for finding and implementing effective methods to control the situation of rumen function and to prevent laminitis syndrome in cattle, especially at the beginning of lactation.

### Material and methods

The study was conducted in the period October 2011 to December 2012, in two groups of 20 cows for milk production to a farm where applicable feeding silage-based. Cows in both groups were selected according to the principle of causality, Holshtein breed, at the beginning of lactation and average production 5000 - 6000 liters of milk per lactation. For the period of experimentation, animals were treated with different food rations. Ration structure was refined with table data, by P. McDonald The bp. (1995) and took into account the content acid-base equivalents and the difference between them (DCAB). In groups of cows were experimented differential feeding in the period up to four months after calving with rations that contain levels of basic and acid equivalents as follows: in the first group of cows, excess dietary acid equivalents were used. Basic difference with those acid equivalents was - 0.35; while the second group of cows, used the composition which provided the difference with those acid-base equivalents in value 137.13.

Throughout the experiment, care was taken to avoid as many other factors influence breeding. In the estimation of acid- basic equivalents was used formula proposed by Breves et al. (1995):

$$D.K.A.B. = (0,35 \cdot Ca + 0,3 \cdot Mg + Na + K) - (0,6 \cdot S + 0,5 \cdot P + Cl)$$

### D.C.A.B. = Dietary Cation-Anion Balance.

From indicators of the study, pH values of rumen content, glucose level, total calcium, inorganic phosphorus and clinical syndrome cases of halting to the cows were chosen four months after calving. Determination of pH of the content of rumen was conducted with the rapid method (with portable pH meter), after receiving naso-esophagale probe, three to four hours after food consumption. Blood samples for assessment of hematobiochemical indicators were taken from the jugular vein of the same animals at the same time. Blood glucose level was determined by rapid enzymatic method. Determining the level of total calcium and inorganic phosphorus was carried out by standard methods. Blood samples and analyzed content of rumen were taken two times per week, every month for the entire period of the experiment.

The cows in the experiment group were clinically evidenced by the presence or not of halting syndrome. Results obtained were processed statistically and defined possible correlative attachments.

### Results

Food rations used in the experiment are shown in Table 1.

The first group of cows were treated with combined meals so as to ensure the dominance of acid equivalents. The basic difference to acid equivalents was - 0.35

**Table1: Indicators of the ration for cows by groups in the experiment.**

Nr.	Groups	Nr. Heads	mEq/g in ration		Diff equiv. Cation - Anion.
			Cation	Anion	
1	First	10	65,95	66,30	- 0,35
2	Second	10	240,14	103,01	137,13

The second group of cows during the experiment was treated with dietary differences that provide acid- basic equivalents as shown in Table 1. Basic difference with those acid equivalents was 137.13. In the experiment, the average levels of ruminal pH were in the Table 2. The average value of ruminal pH to a four-month period was  $0.3 \pm 5:51$  cows in the first group, and  $5.92 \pm 0.3$  in the second group. The data obtained after processing showed changes and differences in average values of pH, ranging from a minimum of 0.37 to 0.82 pH units.

**Table 2: The average of pH rumen content in cows, according after calving months.**

Group of cows	Average of pH rumen content according months				Average level
	Month I	Month II	Month III	Month IV	
First group	$5.43 \pm 0.3$	$5.54 \pm 0.4$	$5.42 \pm 0.2$	$5.44 \pm 0.3$	$5.51 \pm 0.3$
Second group	$5.91 \pm 0.1$	$6.1 \pm 0.3$	$6.24 \pm 0.2$	$5.87 \pm 0.3$	$5.92 \pm 0.3$
Difference $\pm$	$(+) 0.52 \pm 0.2$	$(+) 0.56 \pm 0.1$	<b><math>(+) 0.82 \pm 0.2</math></b>	$(+) 0.37 \pm 0.3$	$(+) 0.41 \pm 0.3$

The data in the first experiment showed that there were ruminal pH values in the intervals below 5.6 and above 5.4. In animals, values suffering from the condition of subacute rumen acidosis in contrast to the second group of cows with average of ruminal pH higher than 5.7 and lower than 6.3 ruminal. In fact., this was the purpose of the study to provoke the situation of subacute rumen acidosis and its impact on hematobiochemical indicators and halting syndrome from laminitis. From the metabolic selected indicators, it was found out that the first group of cows to experiment with the lowest level of pH of ruminal content, lower levels of blood glucose were discovered and, for the entire time of the experiment, (Table 3). In the second group of cows, regardless of the level of glucose in blood, it was higher than the in animals of the first group, two cows were found with hypoglycaemia. The data obtained for the mean values of glucose by groups confirmed statistically ( $P < 0:05$ ).

**Table 3: The average level of glucose in cows of experiment groups, according after calving month.**

Group of cows	Average level of glucose according months mMol/litër (M $\pm$ m)				Average level
	Month I	Month II	Month III	Month IV	
First group	$1.83 \pm 0.03$	$1.84 \pm 0.04$	$1.84 \pm 0.02$	$1.92 \pm 0.03$	$1.87 \pm 0.03$
Second group	$2.22 \pm 0.01$	$2.13 \pm 0.01$	$2.2 \pm 0.02$	$2.17 \pm 0.01$	$2.12 \pm 0.02$

In the experiment period (Table 4), there were also significant differences in the overall level of calcium and inorganic phosphorus in the blood.

**Table 4: Biochemical indicators (Ca and P) in blood of cows in the experiment groups, according months after calving.**

Group of cows	Average level of Ca and P according months in mg% (M ± m)								Average level	
	Muaji I		Muaji II		Muaji III		Muaji IV			
	Ca	P	Ca	P	Ca	P	Ca	P	Ca	P
First group	8.2	5.5	7.8	5.8	7.6	5.9	7.9	5.6	7.71	5.83
Second group	9.01	6.1	9.2	5.9	9.4	5.7	9.3	6.1	9.24	6.12
Difference ±	1.21	0.2	1.6	0.4	1.2	- 0.2	1.4	0.5	1.53	0.29

The average levels of total calcium were higher in cows of the second (respectively  $9,24 \pm 0,4$  mg % versus  $7,71 \pm 0,11$  mg% in cows of first group), as well as inorganic phosphorus levels ( $6,12 \pm 0,3$  mg % in second group, versus  $5,83 \pm 0,13$  mg %, in first group). The data obtained for the mean values of these indicators and differences between groups were statistically verified ( $P > .95$ ). At the end of the experiment period, halting syndrome was observed clinically in seven heads or 17.5% of the animals in the experiment. From cows with halting syndrome, six heads (30.0%) belonged to the first group of experiments, which were treated with dietary equivalent to the difference of those acid- basic - 0:35 and 1 head (5.0%) of the second group, which was treated with dietary differences with those acid- basic equivalents 137.13 (Table 5). The largest number of cows with halting syndrome from laminitis was observed during the second and third months after calving.

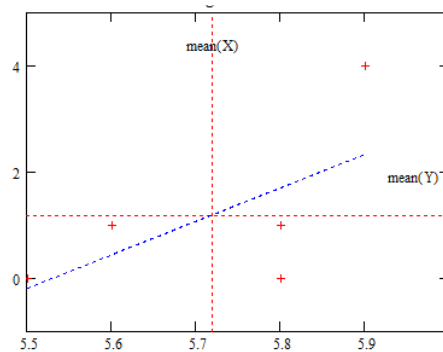
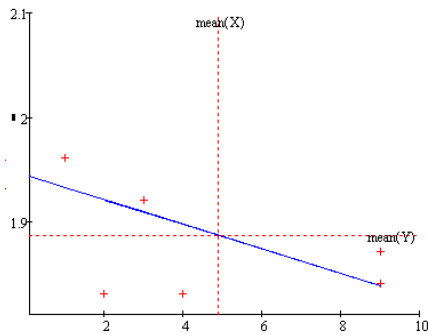
**Table 5: Halting cow syndrome, according after calving months and experiment groups.**

Group of cows (heads)	Cows with laminitis, according months after calving				In total heads in %
	Month I	Month II	Month III	Month IV	
Exsp.group (20)	<b>0</b>	<b>1</b>	<b>4</b>	<b>1</b>	<b>6 = 30.0 %</b>
Contr. group (20)	<b>0</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>1 = 5.0 %</b>
Total (40)	<b>0(0.0)</b>	<b>2 (5.0)</b>	<b>4 (10.0)</b>	<b>1(2.5)</b>	<b>7 = 17.5 %</b>

Statistical processing of data and comparing affiliation between factors, highlight the presence of negative character and correlative relations between the pH of rumen content ( $r = - 0428$ ) and the number of cows with halting syndrome from laminitis. Stronger links correlative negative character ( $r = - .686$ ), and there between the level of glucose in the blood from the number of cows that manifest based halting syndrome.

**Figure 1: Attachments between the level of pH in the rumen contents and the number of cows with laminitis expressed in linear regression graph.  $r = -0,428$**

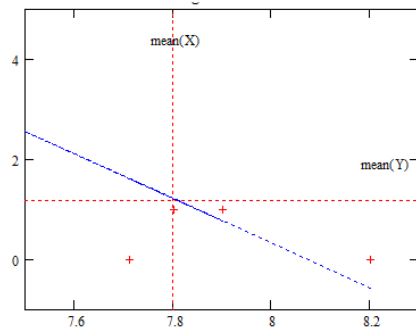
Cows with laminitis =  $21,09 + (-3,54 \times \text{pH ruminal})$



**Figure 2: Attachments between glucose levels and the number of cows with laminitis expressed in linear regression graph.  $r = -0,686$**

Cows with laminitis =  $1,943 + (-0,011 \times \text{gluk. mMol/l})$

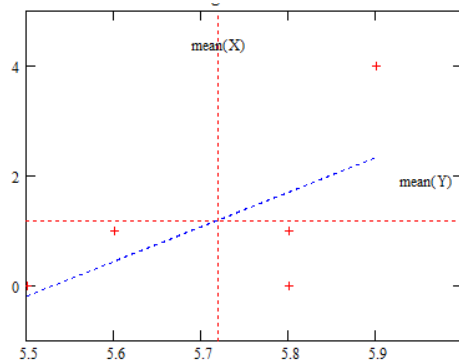
About character strengths and negative ( $r = -0,791$ ) were among the general level of calcium in the blood by the number of cows that manifested clinically halting syndrome from laminitis.



**Figure 3: Attachments between total calcium level and the number of cows with laminitis expressed in linear regression graph.  $r = -0,791$**

Interconnection between inorganic phosphorus and the number of cows with laminitis syndrome was (in contrast with the overall level of calcium) strong and positive in character, Figure 4.

Cow with laminitis =  $36,09 + (-4,47 \times \text{Ca mg\%})$



**Figure 4: Attachments between inorganic phosphorus level and the number of cows with laminitis expressed in linear regression graph.  $r = 0,629$**

Cow with laminitis =  $(-34,81) + (6,29 \times \text{P mg\%})$

## Discussion

Laminitis displaying in cows is a slow process, JE Nocek (2003). In its development appears to play a role and factors closely related to the composition and structure of the ration (Brown MS, (2000). In the experiment, it was proven that the feeding of cows for milk production during the first lactation with rations of high content of acid equivalents provokes the situation of emergence of rumen acidosis followed by decline in blood glucose levels. The state of acidosis reduces and effect of calcium absorption in the intestine (FJ Manson, 2001). Indicators pH of ruminal content and blood glucose levels determine the best state of the subacute rumen acidosis conditional on the composition of the ration (Ceroni V.,2005). The low level of pH of ruminal content when maintained for a long time affects the emergence of halting syndrome from laminitis in cattle and it is because of the low pH value that affects the statement of rumen microbial flora bringing more active development of acid organisms (*S. bovis* and *Lactobacillus*) and the intensification of the lactic fermentation of glucose production (FJ Manson, 2001). In such circumstances, there is damage of bacterial populations in rumen content with increased production of endotoxin that provoke clinical laminitis. In animals that consumed for food ration containing low basic equivalents associated with symptoms of subacute rumen acidosis for a long time, Hypoglycemia and hypocalcemia, it was observed that the frequency of laminitis in cow was up 30.0%, a figure that is close to Clarkson data of MJ bp. (2006), Mortensen (1999) and Guard C. (1995).

## Conclusions

1. The structure of the ration of dairy cows plays an important role in the clinical laminitis.
2. The use of food rations with high content of acid equivalents provokes the situation of subacute rumen acidosis followed by reduce of glucose level in blood.
3. Subacute rumen acidosis provokes the decrease of the overall level of calcium in the blood and increase the relative level of inorganic phosphorus.
4. Glucose and total calcium in the blood can be used as indicators to assess the condition of subacute rumen acidosis in dairy cows during the first lactation.
5. In cows with subacute rumen acidosis, with hypoglycemia and hypocalcemia after calving, there was an increased density of halting syndrome due aseptic laminitis, in 30.0%.

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