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Original paper

The Ruminal Acidosis's effect over the Milk production in dairy Cows

VASILE BOGHIAN[1]

[1]University of Agricultural Sciences and Veterinary Medicine „Ion Ionescu de la Brad", Iasi, Romania

Abstract

The ruminal acidosis is a decrease in the ruminal pH by the accumulation of acidic metabolites at this level. As a result, the proportion of ruminal volatile fatty acids and glycaemia changes with immediate repercussions on the milk production.

Of the total ruminant-reticular indigestions diagnosed in a lot of 370 cows, 37.9% were represented by ruminal acidosis. Out of these, most of the cases (90.9%) had a subacute evolution, which implies difficulties of diagnosis under farm conditions.

On the other hand, the amount of milk was, on average, smaller with 1.7 liters in cows with ruminal acidosis compared to the clinically healthy cows. Milk fat decreased from 3.8% to 2.8% in sick cows, by an average of 1% and had a coefficient of variation of individual values almost double compared to the values obtained in clinically healthy cows. This shows the direct implication of ruminal acidosis over milk production. Appart of ruminal paresis and indigestion, milk production's impairment is an important clinical sign in most of the dairy cows with ruminal acidosis.

Keywords Cow, ruminal acidosis, milk production.

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✉ *Corresponding author: VASILE BOGHIAN, University of Agricultural Sciences and Veterinary Medicine „Ion Ionescu de la Brad", 3-8 Sadoveanu M. Alley, 700490, Iasi, Romania,
E-mail: vboghian@yahoo.com

Introduction

Raising dairy cows in an intensive system generates food hygiene difficulties in the form of nutritionally balanced food rations that meet the individual physiological requirements of each animal. Thus, the biochemical ruminant-reticular indigestions appear, more common being ruminal acidosis, which is also a starting point for other digestive disorders or disorders from the sphere of reproduction (K.A. BEAUCHEMIN & al [1], D.W. BEVANS & al [2], F.N. OWENS & al [3]).

The purpose of the study is to establish the relationship between ruminal acidosis and the quantity and quality of milk, so that, starting from this aspect, it can be able to intervene therapeutically in a short time, before the aggravation of the symptomatology.

Material and Method

The researches were carried out for a year on a lot of 370 dairy cows.

By clinical examination, focusing on rumination, the number and intensity of ruminant-recticular contractions and the pH of the ruminal content, were diagnosed various ruminant-reticular indigestion. In cows where the number of mastications for a mericic bowl has decreased below 40, ruminal fluid was collected with the probe and its pH was determinated with indicator paper. In cows diagnosed with ruminal acidosis, the dynamics of clinical signs were followed daily throughout the treatment, which was on average of 4 days for each individual case, with only one case having a more severe evolution.

To appreciate the influence of the disease on milk production, were daily measured, morning and evening, the quantity of milk collected and its fat percentage by acid-butyrometric method.

The same observations and determinations were made on an equal number of clinically healthy cows from the same herd, with a relatively similar physiological state and benefiting from the same food hygiene conditions.

The primary data were processed statistically by calculating the arithmetic mean with variation limits (x ± Sx) and the coefficient of variation (V%), thus:

$$x = \frac{x_1 + x_2 + x_3 + \cdots\cdots x_n}{n} \cdots\cdots S_n = \sqrt{\frac{\sum_{i=1}^{n}(x_i - x)^2}{n(n-1)}} \cdots\cdots V\% = \frac{\sqrt{\sum_{i=1}^{n}(x_i - x)^2}}{x} \times 100$$

Results and Discussions

Out of a herd of 370 cows, 29 ruminant-reticular indigestion were unevenly diagnosed during one year, 37.9% being represented by ruminal acidosis (Table 1). These were the consequence of the introduction into the diet of new fodder assortments, without a period of accommodation (K.M. KRAUSE & al [4], G.B. PENNER & al [5], J.C. PLAIZIER & al [6]).

Table 1. The incidence of ruminant-reticular indigestions

Ruminant-reticular indigestion		Period of the year			Total
		Winter	Spring/Summer	Autumn	
Ruminal acidosis	no	5	4	2	11
	%	1,4	1,1	0,5	3,0
Simple biochemical ruminal indigestion	no	1	1	2	4
	%	0,3	0,3	0,5	1,1
Paresis / Chronic ruminal meteorism	no	4	2	2	8
	%	1,1	0,5	0,5	2,1
Indigestion through overload	no	2	1	3	6
	%	0,5	0,3	0,8	1,6
Total	no	12	8	9	29
	%	3,3	2,1	2,4	7,8

In cows with ruminal acidosis, the pH of the ruminal content (5.8 ± 0.08) at the time of diagnosis had average values with 0.8 lower compared to the clinically healthy cows (6.6 ± 0.07), while the coefficient of variation (V%) was relatively similar (4.31≈3.63). At the same time, the rumination, although complete, had on average 10 mastications / mericic bowl less, in cows with ruminal acidosis having a coefficient of variation (V% = 2.84) that is visibly lower compared to that of clinically healthy cows (V% = 6.66). This shows the influence of ruminal acidosis on rumination, grouping its values around a lower mean value (37.6 ± 0.33) (Table 2).

Table 2. Aspects regarding rumination, pH of ruminal content, milk quantity and percentage of milk fat in cows with ruminal acidosis

No	Lacta-tion	Lacta-tion month	Mastications / mericic bowl		pH ruminal		Quantity of milk		% milk fat	
			a	b	a	b	a	b	a	b
1	6	3	38	40	5,5	6,5	8	10	2,6	3,2
2	7	4	37	47	6	6,5	10	10	2,8	3,0
3	6	5	39	45	6	7	8	9	2,9	3,0
4	6	1	38	46	5,5	6,5	8	9	2,8	3,2
5	7	2	38	46	6	6,5	9	10	3,2	3,5
6	5	6	36	44	5,5	7	7	8	2,6	3,2
7	5	6	38	49	6	6,5	9	10	3,0	3,2
8	7	5	36	48	6	7	8	9	2,8	3,0
9	6	4	39	50	5,5	7	8	10	2,7	3,5
10	5	3	37	50	6	6,5	7	9	2,8	3,2
x±Sx			37,6±0,33	46,5	5,8±0,08	6,7	8,2±0,29	9,4	2,8±0,05	3,2
V%			2,84		4,31		11,2		6,52	

Legend: a-at the time of diagnosis; b-after treatment

The fact that in ruminal acidosis the rumination is influenced, together with the low pH of ruminal content, shows the change of biochemistry at this level with the modification of the proportion of lower fatty acids and the increase of lactic acid. These disorders will be clinically expressed by changing the quantity and quality of milk (C.M. ROSCA & al [7], K. MACMILLAN & al [8], D.D. MAULFAIR & al [9], D. KUČEVIĆ & al [10]).

Milk quantity was on average smaller with 1.7 liters in cows with ruminal acidosis (8.2 ± 0.29) compared to clinically healthy cows (9.9 ± 0.4), with a coefficient of variation (V% = 11.2) relatively similar (V% = 12.99). Instead, the average percentage of milk fat decreased in sick cows (2.8 ± 0.05) compared to clinically healthy cows (3.8 ± 0.04), with a coefficient of variation (V% = 6.52) almost double (V% = 3.61). This shows the direct implication of ruminal acidosis especially on the percentage of milk fat, determining its variations from average depending on the individual and the intensity of the disease (Table 3).

Table 3. Aspects regarding rumination, pH of ruminal content, milk quantity and percentage of milk fat in clinically healthy cows

No.	Lactation	Lactation month	Mastications / mericic bowl	pH ruminal	Quantity of milk	% milk fat
1	6	4	43	7	11	3,7
2	7	1	48	6,5	12	4,1
3	6	3	53	6,5	10	4,0
4	7	6	47	6,5	9	3,8
5	8	2	44	7	10	3,8
6	5	3	46	6,5	8	3,9
7	7	3	51	6,5	10	3,9
8	6	4	45	6,5	11	3,8
9	6	2	50	7	10	3,8
10	6	5	47	6,5	8	3,9
x±Sx			47,6±1	6,6±0,07	9,9±0,4	3,8±0,04
V%			6,66	3,63	12,99	3,61

The treatment of ruminal acidosis was carried out with sodium bicarbonate added to the concentrated feed in a proportion of 2% and the suplimentation of the feed ration with hay. Thus, in about 4 days the pH of the ruminal content returned to physiological values, but the milk quantity and its fat percentage remained below the average values of the control group (9.2 liters of milk / day with 3.2% fat). This is explained by the homeostasis disorders that accompany ruminal acidosis, especially hypoglycemia (X. GAO & al [11], T. SCHWAIGER & al [12]).

Out of the 11 cases of ruminal acidosis, only one had an acute evolution with a profound change in the general condition: anorexia, deviation, tachycardia (90 / minute) and slight tachypnea (55 / min). After about 2 days the animal prefers decubitus (following the laminitis), ruminant-reticular paresis and diarrhea with dark color feces and unpleasant smell, without changes in volume of the abdominal contour. The evolution of the disease was about 6 days. The treatment was performed with 150 g of calcium bicarbonate administered orally for 4 days and general supportive treatment with energizing and vitaminized solutions.

As a result of the treatment, there was a progressive and almost constant increase of the pH of the ruminal content (Figure 1).

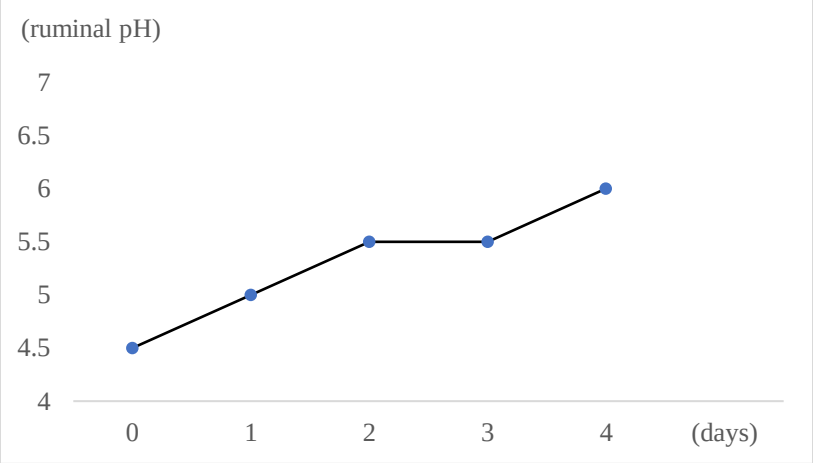

Figure 1. pH dynamics of the ruminal content during treatment

On the other hand, the amount of milk and the percentage of milk fat suddenly decreased on the first day of illness and did not return to the previous parameters after 4 days of treatment (Figure 2).

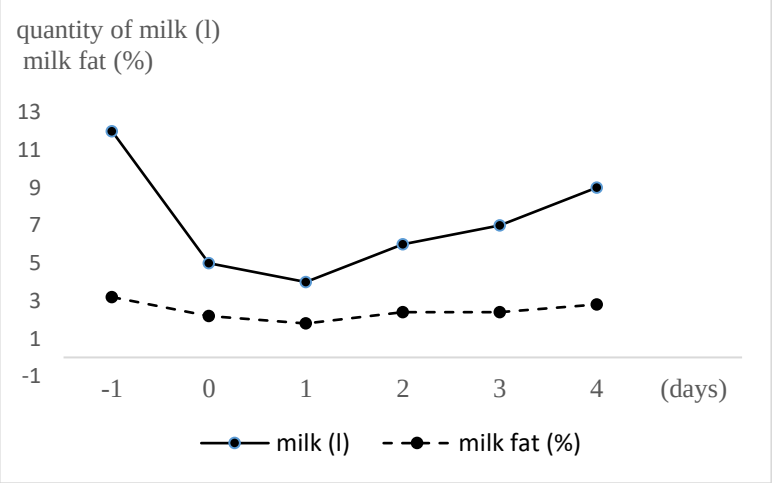

Figure 2. The dynamic of milk quantity and percentage of milk fat during treatment

Conclusions

Out of the total of ruminant-reticular indigestion, 37.9% were represented by ruminal acidosis, which in majority of the cases (90.9%) had a subacute evolution, which implies diagnostic difficulties in farm conditions.

In dairy cows more often the only signs that draw attention to the onset of the disease are the changes of milk production.

The influence of ruminal acidosis on the milk production and its fat percentage is long-lasting, the quantity and quality of milk not exceeding the previous parameters even after treatment.

Conflict of Interest

The author has no conflict of interest to declare.

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