Metabolic processes in calves and their correction in the conditions of Kyrgyzstan

Mucanbet Nogoibaev[1*], *Kamil* Tokoev[1], *Munara* Konushbaeva[1], *Aida* Omurbaeva[1], *Kylymbek* Kulukeev[1], and *Saltanat* Dubanbek kyzy [1]

[1]Kyrgyz National Agrarian University named after. K. I. Skryabin, Bishkek, Kyrgyzstan

Abstract. This scientific work shows the results of using a new mineral-vitamin premix "Ketgib-2" and an anti-ketosis-adaptogenic solution for metabolic disorders in local breed calves. To test the drug, "Ketgib-2" and the anti-ketosis-adaptive solution, we carried out scientific and experimental studies in experimental farms of the Chui region (AC "Chabrec", AC "Vetka") and the scientific laboratory of the Department of Internal Animal Diseases of the Kyrgyz National Agrarian University named after K. I. Scriabin. To develop new effective methods of correction for metabolic disorders in calves in experimental farms, we have set specific goals and objectives: to study the peculiarities of changes in the morpho-biochemical status of the blood in calves suffering from antenatal ketosis, as well as to test new drugs "Ketgib-2" and anti-ketosis-adaptogenic solution. Based on the scientific results obtained, we can draw the following conclusions that giving calves sick with antenatal ketosis the new drug "Ketgib-2" and an anti-ketosis-adaptogenic solution has a very positive effect on the primary indicators of metabolism and, therefore, on the general resistance of the animal's body.

1 Introduction

In the development of the economy of the Kyrgyz Republic, the agricultural sector occupies a vital place, and livestock farming is the leading direction. The transfer of livestock farming to market relations has posed several new problems for veterinary science; one of them is the study of metabolic diseases (antenatal ketosis) in young animals and the development of effective therapeutic methods. We have proven that antenatal ketosis in calves often occurs as a result of the breeding stock suffering from hidden diseases with metabolic disorders [1] and some scientists like I. G. Sharabrin (1975) noted that mother cows with ketosis give birth to calves with ketosis (up to 50-60%). Other domestic and foreign researchers came to the same conclusions [2]. However, in the available literature, there are almost no corrective methods of treatment for antenatal ketosis of calves, except for individual works [3,4,5]. In this regard, we consider it an urgent task to study metabolic disorders in newborn calves and, at the same time, test new corrective drugs, such as "Ketgib-2" and an anti-ketotic-adaptogenic solution.

* Corresponding author: mnogoibaev@mail.ru

2 Materials and methods

Scientific and experimental studies were carried out from 2000 to 2020 in experimental farms of the Chui region (AC "Chabrec", AC "Vetka") and the scientific laboratory of the Department of Internal Animal Diseases, KNAU named after. K. I. Scriabin. We conducted scientific experiments on 12 newborn calves. We obtained an experimental group of 6 calves (sick) from cows with ketosis and a control group of 6 calves (healthy) from healthy cows, considering age, breed, and physiological state; they were selected according to the principle of paired analogs. We kept experimental calves (from experimental and control groups) on a diet that complied with VIJ standards. For metabolism and ketotic state correction of sick calves, we have developed a new drug “Ketgib-2” (see Table 2) [7,8,9]. Calves of the experimental group in the amount of 6 animals received the drug "Ketgib-2" for 30 days; in addition to the main diet, an anti-ketosis-adaptogenic solution was used subcutaneously for 5 days in the following composition: 10-20 ml of 40% glucose solution mixed with 10-20 ml of 0.9% sodium chloride solution, ascorbic acid was added to them at the rate of 10-15 mg/kg of live weight [10]. The control group (6 animals) did not receive any drugs, i.e., remained only in the VIJ diet. In the morning, we took the blood from the jugular vein for the study. In the experimental (experimental and control) groups of calves, we carried out morphological and biochemical blood tests, where we determined the following: the number of erythrocytes, leukocytes, hemoglobin, lymphocytes, sugar, total protein, calcium, phosphorus, reserve alkalinity, and ketone bodies. Morpho-biochemical studies in experimental groups of animals were conducted according to the methods adopted in veterinary medicine [11]. We conducted mathematical processing of the obtained data using the MS Excel program on an IRULED-21.5 computer. Differences in values are presented as the arithmetic mean (M ± m) standard error of the mean. The significance of the differences ($P \leq 0.05$, $P \leq 0.5$) was determined using the Student's t-distribution table.

3 Results

Based on research conducted on experimental farms in the Chui region, we concluded that mother cows with metabolic disorders give birth to calves with antenatal ketosis (toxicosis) (M.D. Nogoibaev et al., 2023). The results of the morpho-biochemical blood status in calves suffering from antenatal ketosis before the use of the new drug “Ketgib-2” and the anti-ketosis-adaptogenic solution are in Table 1.

Table 1. Morpho-biochemical blood parameters in experimental calves before and after the use of the drug “Ketgib-2” and an anti-ketosis-adaptogenic solution

No.	Indicators	Experimental group (sick calves)		Control group (healthy calves)	
		Prior to the usage of the drug	After the usage of the drug	Prior to the usage of the drug	After the usage of the drug
1.	Red blood cells, in 10^{12}/L	7,36 ±0,22	8,5±0,45	8,6 ±0,41	6,3±0,16
2.	Leukocytes, in 10^{9}/L	9,2±0,21	9,6 ±0,43	9,6±0,57	9,2 ±0,32
3.	Hemoglobin, g/L	103,6±0,24	111,4 ±0,33	112,0 ±0,14	103,2±0,12
4.	Lymphocytes, %	43,4±0,12	52,4 ±0,01	56,4 ±0,05	46,4±0,22

5.	Sugar, mg %	56,7±0,04	62,1 ±0,11	65,4±0,55	47,6 ±0,44
6.	Total protein, g/L	62,7±0,45	62,1±0,61	66,3 ±0,14	46,1±0,62
7.	Calcium, mg %	11,1±0,21	11,3±0,24	10,5±0,43	8,5±0,61
8.	Phosphorus, mg %	4,2±0,34	6,4 ±0,21	5,2±0,31	5,2±0,23
9.	Reserve alkalinity, vol. % CO2	22,2±0,97	52,4±0,45	52,4±0,34	50,2 (+-)
10	Ketone bodies, mg %	13,3 ±1,7	6,03 ±0,77	5,3±0,54	3,2±0,17

Analyzing the data in Table 1, we may note that some indicators of the morphological composition of blood in calves change significantly: the number of erythrocytes in animals of the experimental group decreased by 1.5%, and the level of leukocytes compared to the indicators of the control group was 0.4% lower. The hemoglobin content in the blood of the control group of calves was 9.0% higher than that of the experimental group, and the number of lymphocytes in the experimental group of calves was 16.8% lower. We found the same changes during a biochemical blood test in the calves of the experimental group compared to the control group: the amount of sugar in the blood decreased by 10.0%, the total protein decreased by 3.8%, and the calcium level in the blood increased by 0.5%. The amount of phosphorus decreased by 1.2% compared to healthy animals, the concentration of reserve alkalinity in the blood in experimental calves was 30.2% lower than in control animals, and the content of ketone bodies increased compared to control ones to 13.3 mg % ($P < 0.05$). To determine the mechanism of action of the drug "Ketgib-2" and the anti-ketosis-adaptogenic solution, we conducted morpho-biochemical blood tests in experimental calves (see Table 1). Based on the data in Table 1, we can assume that giving sick calves the new drug "Ketgib-2" and an antisense-adaptogenic solution positively affected the primary indicators of metabolism and, therefore, the general resistance of the animal's body [12]. Thus, in the calves of the experimental group, the content of erythrocytes exceeds that of the control group by 2.2%, the number of leukocytes by 0.3%, and hemoglobin by 7.5%. More noticeable was the normalization of lymphocytes in the experimental group to 52.4%, while in the calves of the control group, they remained within the range of 36.4%. The total protein in the blood of calves in the experimental group compared to the control group reached 62.1%, and the difference was 16.1%. We found the most dramatic differences in the blood sugar content of calves in the experimental group: its amount was 11.1% higher than in the control group. The reserve blood alkalinity increased by the same difference in all calves in the experimental group, especially at the end of the experiment, and amounted to 2.1%. Indicators of total calcium in the blood of calves in the experimental group differ markedly compared to the control group, and more by 2.1%. The amount of phosphorus in the blood of calves in the experimental group was up to 1.0% higher than in control animals, and the level of ketone bodies was within the range of 6.03 mg%, i.e., fluctuated within normal limits ($P \leq 0.5$).

Table 2. Composition of the mineral and vitamin drug "Ketgib-2"

No.	**Components**	**Daily dose**	
		per calf	**per ton of filler**
M I N E R A L P A R T			
1.	Magnesium sulfate, g	8	32 kg

2.	Copper sulfate, mg	15	60 g
3.	Zinc sulfate, mg	35	140 g
4.	Manganese sulfate, mg	60	240 g
5.	Cobalt chloride, mg	1,5	60 mg
6.	Iron sulfate, mg	180	720 g
7.	Potassium iodide, mg	0,9	3,6 g
8.	Aniline selenite, mg	12	48 g
9.	Citric acid, g	11	44 kg
10.	Sodium bicarbonate, g	15	60 kg
VITAMIN PART			
11.	Vitamin A, IU	7000	28000
12.	Vitamin E, mg	6	24 g
13.	Vitamin D, IU	200	800000
14.	Gentianella turkestanorum, g	25	100 kg
15.	Barley chop, kg (filler)	0,250	1000 kg

4 Discussion

In many studies [2], it is noted that mother cows with ketosis give birth to calves with ketosis. In addition, the research of other scientists, such as M.S. Mederbekova, O.D. Duyshekeev (2008), E.O. Skorykh (2014), M.D. Nogoibaev et al. (2019, 2023) confirmed this. However, corrective treatment methods have not been studied, especially for antenatal ketosis of calves. And this became one of the tasks of our research. Our research suggests that the primary indicators of metabolism in newborn calves with antenatal ketosis, compared with healthy (control) calves, undergo significant changes, i.e., there is a decrease in the number of red blood cells, hemoglobin, lymphocytes, leukocytes, total protein, sugar, phosphorus, reserve alkalinity and, conversely, an increase in ketone bodies. To correct impaired metabolism with a high content of ketone bodies (up to 13.3 mg%) in calves suffering from antenatal ketosis, we used new drugs “Ketgib-2” and an anti-ketosis-adaptogenic solution.

5 Conclusion

Antenatal ketosis (toxicosis) of newborn calves in local breeds in Kyrgyzstan is widespread and occupies from 3 to 43.6% (M.D. Nogoibaev et al., 2019), but their corrective treatment has not yet been developed. In this regard, we experimentally studied the features of the

development of antenatal ketosis in newborn calves, and we found that significant changes occur in the primary indicators of metabolism in sick calves (erythrocytopenia, leukocytopenia, lymphocytopenia, oligochromaemia, hypoglycemia, hypophosphatemia, metabolic acidosis, hypercalcemia, hypoproteinemia, hyperketonemia). After the usage of the anti-ketosis-adaptogenic solution and the drug "Ketgib-2", morpho-biochemical and immunological blood parameters improve in calves with antenatal ketosis; in particular, the content of erythrocytes, leukocytes, hemoglobin, lymphocytes, total protein, sugar, reserve alkalinity, phosphorus, and calcium increases, and vice versa, the number of ketone bodies decreases - to 6.03 versus 13.3 mg% ($P<0.05$). Thus, normalization occurs in the primary metabolism indicators and the general body resistance of newborn calves with antenatal ketosis.

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