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KETOSIS IN CATTLE: OVERVIEW OF DIAGNOSTIC METHODS

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Ketosis of cows is a mainly chronic disease, accompanied by the accumulation of ketone substances in the body, damage to the pituitary gland - the adrenal system, thyroid, parathyroid glands, liver, heart, kidneys and other organs of the systems.

In the Republic of Kazakhstan, the review questions of distribution, diagnosis, treatment and prevention of ketosis of dairy cows are insufficiently studied. There are data on studies of dairy herds in the conditions of Bayserke-AGRO LLP (Ivanov NP et al. 2014), where as a result of clinical, biochemical and pathologic-anatomical studies 48 heads of cows with ketosis were identified[1].

The prevalence of ketosis in dairy cows in the European Union has until recently been largely unexplored. However, in the messages of Anna C. Berge. (2013) indicates that this problem is widespread and incurs high production costs. Suthar V.S. in 2011-2012 (2013) conducted research on 528 dairy herds from Croatia, Germany, Hungary, Italy, Poland, Portugal, Serbia, Slovenia, Spain and Turkey. The concentration of BHVA in 5884 cows was determined in the period 2-15 days after calving. The overall prevalence of subclinical ketosis in cows in 10 countries was 21.8%, ranging from 11.2 to 36.6%. Cows with subclinical ketosis were 1.5, 9.5 and 5.0 times more likely to develop metritis, clinical ketosis and rennet displacement, respectively. In the postpartum period, when the concentration of BHVA in the blood was ≥ 1.1 mmol / l, the risk of cow lameness increased by 1.8 times. In general, the highest incidence of ketosis was observed from 2 to 15 days after calving, and the risk of metritis, clinical ketosis, lameness, and abomasum displacement in dairy herds in EU countries increased[2].

The urgency of this problem is confirmed by the results of studies of Cherniavskaya M. (2014), conducted in the Republic of Belarus, where ketosis is the second most common disease after mastitis.

The clinical signs of ketosis often remain unnoticed by farmers and veterinarians, as a result, the true prevalence of ketosis is not diagnosed (McKay, S. 2012).

Negative energy balance (NEB) usually occurs in cows during the early lactation period, when the energy from feed intake is not enough for milk production. In order to get more energy, cows have to expend their own stored energy reserves (fat) to produce non-esterified fatty acids (NEFA) and ketone

bodies (for example, beta-hydroxybutyric acid, also known as β -hydroxybutyrate, BHBA), which are used in as an alternative energy source.

Increased blood levels of NEFA and BHBA are normal in the period from the last months of pregnancy to early lactation, when the cow adapts to physiological changes. However, in cows that do not tolerate energy deficiencies, there is an excess of NEFA and BHBA.

It has been proven that excessive content of non-esterified fatty acids and beta-hydroxybutyric acid, especially in cows with hyperketonemia (BHBA concentration in the blood of 1-1.2 mmol / l and higher, that is, subclinical and clinical ketosis), has a detrimental effect on the immune function, milk production and general health of these cows.

In many dairy herds, the frequency of occurrence of hyperketonemia during the first two weeks of lactation ranges from 40 to 60 percent. If we take into account that 85-95% of cows with hyperketonemia do not show signs accompanied by the clinic of classical ketosis, then often if the cow goes from dryness to lactation improperly, the consequences for her health and productivity go unnoticed, which means lost economic opportunities[2,3,4].

Thus, timely early diagnosis of subclinical forms of ketosis is a prerequisite for increasing the productivity of cows and maintaining the viability of the young.

Clinical ketosis has visible clinical symptoms and usually manifests during the first six to eight weeks after calving, resulting in anorexia, lizuha and blindness, severe dry feces, rapid loss of quality and a decrease in the amount of milk (Youssef M.A. et al., 2010). In addition, milk fat in ketotic cows increases due to the presence of BHBA and fatty acids. Clinical ketosis is easily diagnosed by its clinical symptoms. Cases of subclinical ketosis in dairy cattle have been identified when excessive levels of circulating ketone bodies are present and there are no clinical signs of ketosis (Andersson L., 1988).

Diagnosis of ketosis is reduced to the detection of ketone bodies, namely acetone, acetoacetic acid and beta-hydroxybutyric acid in biological fluids (blood, urine, milk) (Berezov TT, 1990). Ketone bodies include beta-hydroxybutyrate (BHBA), acetoacetate (AcAc) and acetone (Ac), in a ratio of 70, 28 and 2%, respectively. BHBA is predominant in the circulation of ketone bodies in ruminants, and there is a strong correlation between the concentration of BHBA and AcAc (Kauppinen K., 1983). Ketone bodies can freely diffuse through the cell membrane and provide energy for long-term starvation (Laffel L., 1999). An increase in the concentration of BHBA in the blood indicates stimulation of the breakdown of fat or excessive absorption of butyrate when feeding on poor quality silage [2, 5].

In addition, the relationship between increased concentrations of circulating ketones and prenatal complications in cows has been described. The proportion of subclinical ketosis described by Enjalbert F. et al. (2000) ranged from 7 to 41%. Therefore, due to its economic consequences, the diagnosis of subclinical ketosis in dairy cows is very important, especially in the early stages of lactation[5].

Materials and methods. The object of the study was Simmental cows, 140 total of them, of which 50 cows were selected for research to determine the

presence of ketone bodies in the blood. The experiment was carried out in the stall winter-spring period in order to determine the subclinical form of ketosis.

The feeding of cows in the farm during the winter-spring period was unbalanced and insufficient, especially in easily digestible sugars, the content of which in the diet 2 times reduced the minimum rate. Sugar-protein ratio was 0.44. In the diet, the rate of hay was significantly underestimated and the root and strawberry crops were completely absent. Corn silage averaged 50% of the total diet, the amount of acids in it was 2.96%, including: milk 46.1%, acetic acid - 51.3% and oil 2.5%.

For the experiment, 0.5 ml of blood was taken from the cows from the jugular vein. Studied cows aged 4-6 years, in the first three months of lactation. Studies were conducted using an electronic device "Free Style Precision".

The results of the study. Of the selected 50 highly productive cows, 23 heads showed clinical signs. According to clinical signs, there were characteristic signs of decrease in productive ability, disruptions in the sexual cycle, milk yield below average, loss of appetite and weight.

In 27 cows, the level of beta-hydroxybutyric acid was 0.6 mmol per liter and less, which is the norm. In 15 cows, the BHBA level varied between 0.6 and 1 mmol / l, which indicates an increase, but does not require urgent measures. The content of ketone bodies above 1 and up to 1.4 mmol / l was in 12 cows, which indicates subclinical ketosis and the need for treatment.

A comparative analysis of BHBA concentration and cow age revealed the following:

- 0.6 mmol / l and less in 17 cows aged 3-4 years and 8 cows 5-6 years;
- 0.6-1 mmol / l in 15 cows: 9 cows aged 3-4 years, 6 cows 5-6 years;
- 1.0-1.4 mmol / l in 12 cows: 8 cows 3-4 years, 4 cows aged 4-6 years.

These data indicate that ketosis often affects young cows and is associated, apparently with a violation of the basic metabolism due to the intensity of physiological processes.

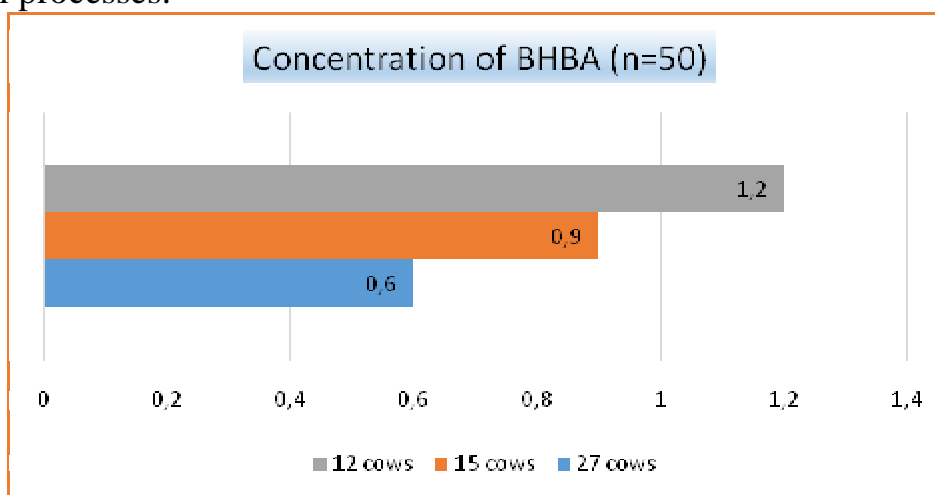


Figure 1 - The average beta-hydroxybutyric acid (BHBA) in the blood of groups of cows

Summary. Subclinical ketoses are one of the leading factors in the occurrence of diseases of reproductive function in cows. High concentration of beta-hydroxybutyric acid in the blood of sick cows is of great diagnostic value. Feed and cow management practices should be primarily focused on preventing ketosis, but timely identification of ketosis in individual cows is critical for quick interventions.

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