нематодиреллами, а также стронгилоидами было инвазировано 2 сайгака (ЭИ 11,76%, ИИ 1-7 яиц); эзоффагастомами – 3 сайгака (ЭИ 17,64%, ИИ 2-13). Таким образом, что из 17 зараженных сайгаков сочетанные инвазии были обнаружены у 4 (23,52%), у 13 (76,47%) установлена моноинвазия.

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METHODS OF DIAGNOSIS OF KETOSIS AND DISEASES OF REPRODUCTIVE FUNCTION IN HIGHLY PRODUCTIVE COWS

ANNOTATION

The article presents methods of express diagnostics and a laboratory method for determining the presence of ketone bodies in blood and urine. The research was carried out in 2018-2019 at the Department of "Veterinary Medicine" of NJSC «Kazakh Agrotechnical University named after S. Seifullin», in the farms of Akmola, Pavlodar and North Kazakhstan regions. The objects of research are cows of Holstein black-and-white and Simmental breeds (n=60) of the first and second lactation, during the early and late start, as well as in the first two weeks after calving. All breeding stock, taking into account the level of ketone bodies, was divided into groups: up to 1 mmol/l – clinically healthy, 1-2,5 mmol/l – subclinical ketosis, more than 2,5 mmol/l – clinically pronounced ketosis. Diagnosis of ketosis and diseases of reproductive function was carried out taking into account the early and late start, as well as the timing after calving cows. Ketone bodies in urine were determined in a qualitative and semi-quantitative way by the equipment of Keto-txt and Girul, Dirul Industrial Co., LTD and according to the Lestrade test method in laboratory conditions. The effectiveness of diagnostic methods for clinical and subclinical ketosis is 85-90%, the laboratory method of urine according to Lestrade is 87%, ultrasound examination of the reproductive system is 80%, rectal examination is 85-93%.

Key words: *cattle, ketosis, diseases of the reproductive system, endometritis, ovarian cyst, express diagnostics, laboratory diagnostics, uterine involution.*

Introduction. Highly productive cows in dairy complexes are kept in order to improve the production of dairy products. At the same time, it is important to take into account the relationship of metabolic processes, inconsistencies with high energy demand and metabolic capabilities of the whole organism. In the conditions of industrial technology of dairy cattle breeding, there is an excessive strain on the body of highly productive cows, in particular parenchymal, reproductive organs and tissues, which leads to the development of pathology and the emergence of new diseases. Diseases of reproductive function in highly productive cows today are one of the most common diseases and occupy a high proportion in the structure of the causes of reduced productivity, total milk yield and productive longevity of the herd [1].

According to literature sources, metabolic disorders in ketosis are accompanied by diseases - hypoglycemia, ketonemia and ketonuria with clinical and pathoanatomic signs, in which the therapeutic effect of glucose is also revealed [2,3,4]. An important factor hindering the dynamic

development of dairy cattle breeding is the high incidence of cows in the postpartum period with metabolic diseases, endometritis, mastitis and hoof diseases. According to a number of scientists, the occurrence of various complications after childbirth is one of the main causes of impaired reproductive function of animals [5].

Metabolic disorders caused by unfavorable conditions of feeding and keeping, reduces the resistance of animals, leads to disruption of the functioning of important organs and systems, and also worsens the vital signs of the whole organism. The failure of metabolism further leads to a decrease in milk productivity, destructive changes in muscle tissue, and a violation of the reproductive ability of cows. Metabolic disorders in the body of high-yielding cows are accompanied by the accumulation of ketone bodies (beta-hydroxybutyric, acetoacetic, acetone), a decrease in glucose levels, damage to the endocrine system, liver, kidneys, auto-intoxication of the body, impaired reproductive function, decreased productivity [6]. Ketosis is widespread among cattle of all breeds everywhere in all climatic zones both in Kazakhstan and in the near and far abroad. On average, the prevalence of ketosis in farms in Germany was 43%, France - 52%, Italy - 31%, the Netherlands - 46%, the UK - 31% [7].

Ketosis is a condition in which the content of ketone bodies in the blood is higher than 1.0 mmol/l [8]. The concentration of ketone bodies is a balance between the number of ketone bodies formed in the liver and the number of ketone bodies disposed of by peripheral tissues [9]. The main reason for the violation of the reproductive system and further infertility are the consequences of pathological childbirth and postpartum diseases of the reproductive system. To the greatest extent, the causes of the above diseases are the reproduction of pathogenic microflora in the uterus and genital tract, postpartum complications that sharply reduce the resistance of animals and cause inflammatory processes of the reproductive system [10]. Untimely, unqualified and unsystematic treatment of animals with acute postpartum endometritis often leads to complications of their chronic, including latent endometritis. In addition, many of the cows with endometritis are culled, and the terms of their productive use do not exceed 4-5 years [11].

Ensuring high milk productivity while simultaneously maintaining the terms of economic use and reproductive function in cows is one of the most urgent tasks of modern dairy farming. One of the main reasons for this phenomenon is considered to be chronic ketosis of highly productive cows due to poor feed quality and insufficient balancing of diets. The disease is diagnosed in countries with highly developed dairy cattle breeding, in particular in the USA, Canada, Germany, Holland, Denmark. In the USA, about 1 million ketosis diseases are observed annually (4% of the livestock). This pathology causes significant economic damage to livestock farms, which is characterized by a reduction in the use of the most valuable highly productive animals up to 3-4 years, a decrease in productivity up to 30-50%, loss of live weight, forced culling of animals, as well as a significant number of infertile cows after being ill and a negative impact on offspring. Even after carrying out a complex of therapeutic measures, the initial productivity of the animal is not fully restored.

The problem of ketosis in dairy cows remains relevant and recently there has been a steady trend towards an increase in morbidity. On average, the clinical form of ketosis is registered in 5% of new-bodied cows, and the subclinical form – in 40%.

This is due, first of all, to an increase in the genetic productivity of dairy herds (the consequences of the import of imported livestock are affected) and, as a result, the inability to establish proper feeding of highly productive animals with a milk yield of more than 6-7 thousand kg of milk.

Ketosis is a common disease of cows of a metabolic nature. Highly productive dairy animals have a sharp increase in milk production after calving. At the same time, animals are not able to consume the amount of dry matter with the diet feed, which is able to compensate for the greatly increasing energy needs. To ensure the synthesis of milk, the body of cows begins to use its own reserves of fat depot and muscle tissue proteins. The intensive process of oxidation of reserve fats causes the accumulation of ketone bodies: acetone, acetobutyric and acetoacetic acids, which predetermine the development of ketosis.

It is known that during the dry period in the cow's body there is an accumulation of nutrients necessary for the animal to successfully overcome the energy post-body imbalance. If we are talking about an animal with a genetic productivity of up to 3 thousand kg of milk per year, then there are no problems with the energy balance after calving; even the traditional "Sovet" technology of feeding new-bodied cows makes up for it. Another thing is when it comes to herds with a yield of 5 or more

thousand kg of milk per year. For example, during the dry season cows have normal fatness or even excessively fat, but after calving in 3-5 days they begin to progressively lose weight and not infrequently this process threatens the life of the animal.

In most cases, the diets of dry cows contribute to the accumulation of energy in the form of subcutaneous fat, which is extremely inefficient in terms of replenishing energy after calving, since its reserves are quickly split, and the energy released is insufficient. Against this background, there is an extremely inefficient splitting and assimilation of protein, as a result of which under-oxidized metabolic products accumulate in the body – a pre-ketosis or ketosis state develops.

Measures to prevent ketosis in cows and heifers include monitoring their live weight before calving, eliminating energy deficiency in the animal body by reducing the proportion of protein split in the rumen in the feed mixture, proper balancing of diets for all nutrients, biologically complete feeding, the use of structural fiber and sugars, rejection of ketogenic ingredients and toxicogenic components (they affect the liver), active exercise and compliance with sanitary and hygienic requirements.

Intensive exploitation of the breeding stock is largely restrained due to the occurrence of various pathological processes in the body and genitals in animals, leading to impaired metabolism, reproductive function and decreased fertility. Postpartum pathology of the uterus includes postpartum endometritis and metritis, including perimetry and cysts, subinvolution of the uterus.

When diagnosing endometritis, the main diagnostic methods are: external examination, rectal and vaginal examination. These methods of research should be carried out in combination with ultrasound examination. Along with conducting external and internal examinations of the uterus, one of the most important methods of diagnosing chronic endometritis in practical veterinary medicine is laboratory diagnostics.

The purpose of our research is to study ketosis and diseases of the reproductive function of cows using clinical and diagnostic methods.

To achieve the goal, the following tasks are set:

1. Examination of the breeding stock of three farms for the presence of ketosis using various diagnostic tests.

2. Diagnosis of diseases of reproductive function in cows by ultrasound and rectal examinations.

3. Establishing the relationship between the degree of incidence of ketosis and diseases of the reproductive function of cows.

Proper maintenance and proper feeding of dairy cattle during the dry period and in the first phase of lactation can reduce the risk of ketosis in new-bodied cows, significantly increase their productivity, improve milk quality, and ultimately increase the profitability of the enterprise.

Materials and methods of research. The research was carried out in 2018-2019 at the Department of "Veterinary Medicine" of NJSC «Kazakh Agrotechnical University named after S. Seifullin», in the farms of Akmola, Pavlodar and North Kazakhstan regions. The objects of research are cows of Holstein black-and-white and Simmental breeds (n=60) of the first and second lactation, during the early and late start, as well as in the first two weeks after calving.

To determine the content of beta hydroxybutyrate in the blood, an electronic device FreeStyle Optium (Abbot Diabetes Care, USA) was used, the determination of ketone bodies in urine by a qualitative and semi-quantitative method was carried out using Keto-test and Girul, Dirul Industrial Co., LTD and Lestrade samples. When applying the Lestrade test method, a dry reagent was used according to the following scheme: sodium nitroprusside in an amount of 1,0 g, anhydrous sodium carbonate in an amount of 20,0, ammonium sulfate in an amount of 20,0 g. A small amount of reagent powder was placed on the filter paper at the tip of the scalpel and a few drops of urine were introduced. With a positive result, the urine was colored from pink to dark purple within 2-3 minutes [9,10]. The diagnosis of diseases of the reproductive system was based on the determination of clinical symptoms, rectal and ultrasound examinations (Esiscan 4 digital scanner, BUG-LED optical glasses with a linear sensor for 128 elements 4,0-8,5 MHz, manufactured in Scotland) and Esiscan ultrasound, with a linear sensor for 85 elements 5,0 MHz, with a device for inserting the probe Introducer, manufactured in Germany.

The study of the energy and protein needs of dry cows suggests that modern feeding methods can lead to a better intake of nutrients that can increase the deposition of fat in the internal organs. In

such conditions, the metabolism of nutrients in a cow may be disrupted. Scientists have shown that limited feeding throughout pregnancy prevents many problems that can affect the reproductive ability of cows [12,20]. The weight loss of the body after calving affects fertilization and an increase in the service life of cows, the authors have proven that the mobilization of body tissues after calving increases the influx of non-esterified fatty acids into the liver. Scientists have considered modern methods of feeding ration in the early lactation period, which are aimed at stimulating milk yields and peak milk yield. From the results obtained, it follows that this approach aggravates the loss of condition, the state of health of cows during calving and fertility. In order to adapt the microflora of the scar and compensate for the expected reduction in feed intake as pregnancy progresses, health problems during childbirth, excessive loss of body condition after calving or decreased fertility were largely unable to overcome [13, 19].

Results and discussion. Diagnosis of cows for the presence of ketosis was carried out in three dairy cattle farms. 450 cows of the breeding stock were tested for the presence of ketosis. The results of the study are presented in Table 1.

Table 1 – Diagnosis of ketosis in highly productive cows (n=450)

Diagnostic methods	Samples with a positive result for the presence of ketosis							
	«Zelenii Luga» LLP		«Konvisher» Farm		«Khamze» Farm		Average number of positively reacting	
	quantity	%	quantity	%	quantity	%	quantity	%
Blood testing with the FreeStyle Optium device	7	4,6	7	4,6	6	4	20	4,2
Milk research by the Keto-TestTM method	6	4	5	3,4	5	3,3	16	3,5
Urine examination, according to the Lestrade method	4	2,6	3	2	5	3,3	12	2,6
In total, with a positive result for the presence of ketosis, the study was conducted in three ways	17	11,2	15	10	16	10,6	48	10,3
Total negative result for the presence of ketosis by a study in three ways	133	88,8	135	90	134	89,4	402	89,7

From the data in Table 1, it follows that in the study of blood, milk and urine samples for a group of cows belonging to Green Meadows LLP, the positively reacting ones were 7, 6 and 4 heads, which in percentage terms, respectively, is equal to 4,6%, 4,0% and 2,6%; in the Konvisher farm, these indicators were: 7, 5 and 3 heads, which in percentage terms were equal to: 4,6%, 3,4% and 2%, and in the Hamze farm, respectively, the indicators of blood, milk and urine samples were: 6, 5 and 5 heads, which is equal to 4%, 3,3% and 3,3%.

According to the results of a dispensary examination of highly productive cows, based on statistical analysis, the percentage of clinical signs in ketosis was determined.

From the data of the medical examination of cattle and the data of the express diagnosis of the disease, it follows that a high percentage of heads was marked with a decrease in body mass index (3,0 ± 0,5) – 76,5%, proteinuria (72,1%), ketonuria (65,3%), with characteristic signs of subclinical ketosis. Qualitative changes in decreased appetite (56,4%), appetite perversions (49,5%), matted hair (45,7%), redness of the eyeball (40,3%), body depression (40,3%) and jaundice of the mucous membranes (38,5%) were noted. An increase in the boundaries of the liver (12,6%) and weak

rumination (54,1%) was noted in cows at the last term of pregnancy and the first two weeks after calving.

At the next stage, 45 heads responding positively to ketosis were examined in order to diagnose violations of the reproductive function of cows (Table 2).

Table 2 – Diagnosis of diseases of reproductive function in cows (n=45).

Name of the farm	«Zelenii Luga» LLP		«Konvisher» Farm		«Khamze» Farm		Average number of positively reacting	
	quantity	%	quantity	%	quantity	%	quantity	%
Методы исследования	Ultrasound (Akuvista– 5.0 MHz) + Introducer		Ultrasound Esiscan 4 - 8,5 MHz		Rectal examination		Average number of heads by diagnosis	
Endometritis, heads/%	6	40	5	33,3	4	26,6	15	33,4
Detention of the afterbirth, heads/%	1	6,6	2	13,4	2	13,4	5	11,1
Ovarian cysts, heads/%	3	20	1	6,6	3	20	7	15,5
In total, with a positive result for the presence of ketosis, the study was conducted in three ways	10	66,6	8	53,3	9	60	27	60
Total negative result for the presence of ketosis by a study in three ways	5	33,4	7	46,7	6	40	18	40

From the analysis of Table 2, it follows that in «Zelenii Luga» LLP, the indicators were distributed: endometritis - 6, retention of the afterbirth - 1 and ovarian cysts - 3, which is 40%, 6,6% and 20%, respectively. In the «Konvisher» farm, the indicators of obstetric and gynecological diseases were: 5, 2 and 1 heads, which amounted to 33,3%, 13,4% and 6,6%, respectively, in the «Khamze» farm, the indicators of these diseases were equal to: 4, 2 and 3 heads, or 26,6%, 13,4% and 20%, respectively.

It should be noted that in all three farms with a larger number of patients with ketosis cows were subjected to endometritis, which in the context of farms was 6, 5 and 4 heads, what percentage was equal to 40%, 33,3% and 26,6%.

On the basis of the conducted research, we can conclude that out of 45 cows studied population of 15 heads were identified endometritis, or 33,4%; the detention of the placenta at 5 heads or 15,5% and ovarian cysts at 7 heads, or 11,1%.

Conclusions. Analysis of blood, milk and urine samples for ketosis in cows in «Zelenii Luga» LLP, positively reacting were 7, 6 and 4 heads, which in percentage terms, respectively, is equal to 4,6%, 4,0% and 2,6%; in «Konvisher» farm, these indicators were: 7, 5 and 3 heads, which in percentage terms were equal to: 4,6%, 3,4% and 2%, in «Khamze» farm, respectively, the indicators of blood, milk and urine samples were: 6, 5 and 5 heads, which is equal to 4%, 3,3 % and 3,3%.

In cows in «Zelenii Luga» LLP, the indicators for endometritis, retention of the afterbirth and ovarian cysts were: 6, 1 and 3 heads, which in percentage terms is equal to 40%, 6,6% and 20%. In the «Konvisher» farm, the indicators of obstetric and gynecological diseases were 5, 2 and 1 heads, which amounted to 33,3%, 13,4% and 6,6%, in the «Khamze» farm, the indicators of these diseases were equal to 4, 2 and 3 heads, which amounted to 26,6%, 13,4% and 20%, respectively.

Of the 45 cows of the studied livestock, endometritis was detected in 15 heads, which was 33,4%; retention of the afterbirth – in 5 heads, which was 15,5% and ovarian cysts in 7 heads, which was 11,1%.

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ТҮЙІН

Мақалада жедел диагностика әдістері және қан мен зәрде кетон денелерінің болуын анықтайтын зертханалық әдіс ұсынылған. Зерттеулер 2018-2019 жылдар аралығында «С.Сейфуллин атындағы ҚазАТУ» КЕАҚ-ң «Ветеринарлық медицина» кафедрасында, сондай-ақ Ақмола, Павлодар және Солтүстік Қазақстан облыстарының шаруашылықтарында жүргізілді. Зерттеу нысаны – бірінші және екінші сауым маусымындағы, ерте және кеш басталу кезеңінде, сондай-ақ бұзаулағаннан кейінгі алғашқы екі аптадағы мерзімдегі голштин қара-ала және симментал тұқымды сиырлар (n=60) болды. Кетон денелерінің мөлшеріне қарай барлық аналық мал басы топтарға бөлінді: 1 ммоль/л дейін – клиникалық сау,1-2, 5 ммоль/л – субклиникалық кетоз, 2,5 ммоль/л – клиникалық айқын кетоз. Кетоз және репродуктивтік функция ауруларының диагностикасы ерте және кеш іске қосылуды, сондай-ақ сиырларды төлдегеннен кейінгі мерзімдерді ескере отырып жүргізілді. Зәрдегі кетон денелері сапалы және жартылай сандық әдіспен Ketto-Test және Girul, Dirul Industrial Co жабдықтарымен және зертханалық жағдайда Лестрад сынақ әдісіне сәйкес анықталды. Клиникалық және субклиникалық кетозды диагностикалау әдістерінің тиімділігі 85-90%, Лестрадтағы зәрдің зертханалық әдісі 87%, репродуктивті жүйенің ультрадыбыстық зерттеуі 80%, ректалды тексеру 85-93% құрады.

РЕЗЮМЕ

В статье представлены методы экспресс-диагностики и лабораторный метод определения наличия кетоновых тел в крови и в моче. Исследования проведены в период 2018-2019 годов на кафедре «Ветеринарной медицины» НАО «КазАТУ имени С. Сейфуллина», а также в хозяйствах Акмолинской, Павлодарской и Северо-Казахстанской областей. Объектом исследований послужили коровы голштинской черно-пестрой и симментальской пород (n=60) первой и второй лактации, в период раннего и позднего запуска, а также в первые две недели после отела. Все маточное поголовье с учетом уровня кетоновых тел было подразделено на: до 1 ммоль/л – клинически здоровые, 1-2,5 ммоль/л – субклинический кетоз, более 2,5 ммоль/л – клинически выраженный кетоз. Диагностика кетоза и болезней репродуктивной функции проводилась с учетом раннего и позднего запуска, а также сроками после отела коров. кетоновые тела в моче были определены качественным и полуколичественным способом оборудованиями Keto-tect и Girul, Dirul Industrial Co., LTD и согласно методу пробы Лестраде в лабораторных условиях. Эффективность методов диагностики на клинический и субклинический кетоз составляет 85-90%, лабораторный метод мочи по Лестраде 87%, ультразвуковое исследование воспроизводительной системы 80%, ректальное обследование 85-93%.