Assessment of the factors influencing the fertility of dairy cows

N B Nikulina, L V Sycheva and V M Aksenova
Perm Agrotechnological University, 23 Petropavlovskaya Street, Perm, Russia, 614990
E-mail: uralskay114@yandex.ru

Abstract. The assessment of factors of reproductive dysfunction of dairy black and white cows of second-third lactation breed weighing 450-500 kg was made in one of the breeding farms of the Perm region. The conditions of keeping animals did not meet the zoo-hygienic standards. For lactating cows a concentrate type of feeding was used. In the structure roughage feed mixture occupied 15% is juicy 25.1 %, concentrated – 59.2 %. The digestible protein content in 1 ECU was 123 g, the sugar-protein ratio was 0.4: 1, the ratio of calcium and phosphorus was 1:2:1, the fiber content of dry matter – 19 %. The preclinical stage of development of postpartum inflammatory processes in the uterus of some animals was noted; the development of clinical metritis of other animals was noted. The decrease in the amount of glucose, reserve alkalinity, carotene, magnesium and a simultaneous increase in the content of ketone bodies was typical of blood of cows with clinical signs of diseases of the uterus as compared with those animals in the premorbital state of reproductive pathology.

1. Introduction
The main problem of dairy farming, which determines the reduction of productivity, economic longevity of cows of the business and output of young animals is the imbalance between the increase of genetic potential of animals and the inadequacy of the technology of their housing, feeding and reproduction. Today, the average period of production use of cows in the country is 2.86 of lactation, and the yield of calves in agricultural enterprises per 100 queens-76-77% [1].

In addition, from each barren cow farm receives less than a minimum of 25% of its milk yield per lactation. To this must be added the cost of treatment, numerous unsuccessful insemination and losses associated with the premature culling of valuable, often young cows [2-5]. The current situation prevents the expanded reproduction of breeding stock, and, consequently, the increase of the genetic potential of milk production [6, 7].

The aim of the study was to assess the factors of reproductive dysfunction in dairy cows in one of the farms of the Perm region.

2. Materials and methods
The study was conducted in the breeding farm during the spring period for dairy cows of black-motley second or third lactation, with weight of 450-500 kg. The system of keeping cows on the farm was year-round stable. The farm used the same type of feeding all year around. The composition of the feed mixture was composed of the following feed: mixed grass hay, silage, mixed grass, mixed fodder, sunflower oil cake, rapeseed oil cake and corn. The structure of the diet was evaluated. Chemical analysis of feed was carried out in "Vereshchagin veterinary agrochemical laboratory".
The analysis of production indicators was carried out for the last 3 years on a card of breeding economy. Clinical examination of the livestock was performed according to the generally accepted scheme existing in veterinary practice. Total protein, albumins, α –, β –, γ – globulins, glucose, reserve alkalinity, urea, ketone bodies, carotene, total calcium, inorganic phosphorus, magnesium were determined in the blood serum of cows by standard methods.

Statistical processing of the results was carried out using the program "Statistis 6” and student criteria for small samples. The critical level of significant statistical hypothesis testing was p < 0.05.

3. Results and Discussion

The animals were in the old building. The poor operations of the manure removal system, high humidity with the formation of condensate on the metal structures of the barn, low illumination were noted. The concentration of harmful gases in the room air exceeded regulatory requirements. Active exercise animals were not provided.

Analysis of the diet showed that in the structure of feeding mixture roughage occupied 15 %, juicy-25.1 % and concentrated – 59.2 %. It was established that for lactating cows the concentrate type of feeding was used. The digestible protein content in 1 ECU was 123 g (norm 95-98 g). Sugar-protein ratio was at 0.4: 1 (at a rate of 0.8: 1). The ratio of calcium and phosphorus was at 1.2: 1, and the optimal is 1.5-2.0:1. The supply of vitamin D was 36.4% from the norm. The fiber content of dry matter was 19 %.

In this breeding farm the number of cattle in the last 3 years decreased by 5-8 %, and the yield of cows for 305 days of the first lactation increased by 1.5-2.5 % (from 6412 to 6667 kg) and for the third lactation – by 8 % (from 6783 to 7350 kg). The duration of production use of cows ranged from 3.7 to 4.0 calving. The yield of calves from cows for 3 years did not change and amounted to 83 %. However the number of inseminated animals decreased by 7% annually, and the number of inseminations per one productive increased up to 3.9. The average duration of the service period was 127 days. At the same time, only 38% of cows had a normal duration of this period (from 90 to 120 days). The dry period averaged 54 days and in 88 % of animals it was 54-70 days. Analysis of production indicators of the economy showed an increase in milk productivity of cows with depression of their sexual function as evidenced by the lengthening of the service period, reducing the number of inseminated cows and increasing the number of inseminations per productive.

Clinical examination of cows showed that all animals had a dull hair cover and there was excessive regrowth of the hoof horn, lameness, decreased activity and appetite, rare, sluggish gum, signs of atony and hypotension of the pancreas and diarrhea.

In 50 % of the examined cows in the first 10-14 days after calving we observed a decrease in body weight (fatness less than 3 points) and milk production and frequent urination. Animals stood for a long time with a raised tail. While lying down, straining of the animal, the acts of defecation and urination of the external genital organs were allocated Fuckers liquid consistency was with an unpleasant putrid odor. The color of the loch varied from grayish-white to brown or dirty-brown, indicating the occurrence of postpartum metritis in cattle.

In the blood serum of all cows recorded a decrease in the concentration of α-globulins reserve alkalinity, total calcium compared with the normative values (Table 1). The total protein content in the blood serum of animals was at the upper limit of the average indicators.

However, the cows with clinical signs of diseases of the uterus had a decrease in the amount of glucose in the blood serum on the average of 29 %, reserve alkalinity 10 %, carotene by 40 %, magnesium by 20 %. We observed the simultaneous increase in the content of ketone bodies in average 2 times in comparison with those in animals without symptoms of metritis, which indicates the violation of protein, carbohydrate, vitamin, mineral metabolism and development of acidosis.

| Table 1. Biochemical parameters of cows’ blood |
The predominance of acidic foods in the diet leads to a sharp decrease in the concentration of insulin and insulin-like growth factor I. It is shown that in highly productive dairy cows the concentration of glucose in the follicular fluid of dominant follicles is similar to that in the blood [10]. This indicates a direct effect of glucose on the quality of sexual and somatic cells of antral follicles.

When considering the efficiency of production farm managers and specialists pay great attention to the issues of animal feeding, however they do not take into account the impact of conditions on the body of cows. The changes in the parameters of the barn microclimate noted by us lead to a violation of the body’s oxygen homeostasis, which causes the development of multi-organ failure. High humidity, untimely manure removal could lead to the proliferation of pathogenic microorganisms in the air, litter and barn structures. While bacteria and viruses from litter fall in the birth canal and the uterus, causing inflammation, which is one of the reasons of barrenness of cows. Low illumination (less than 50 Lux) was perceived by a cow at night, which helps to reduce the production of hormones, including sexual ones.

There is no doubt that the imbalance of diets even for several nutrients can lead to serious disorders of the whole body. The noted imbalance of nutrients in the diet of animals contributed to the change of metabolism of dairy cows. Thus in the blood of cattle was noted the change in the ratio of globulin protein fractions in the normal content of total protein, which may be associated with the development of the inflammatory process in the uterus, as acute-phase proteins (C-reactive protein, ceruloplasmin, and proteins of the complement system) are part of this fraction.

It is known that the deficiency of easily digestible carbohydrates in food, the use of a large number of concentrates and the predominance of acidic foods in the diet leads to a sharp decrease in the concentration of propionic acid necessary to maintain the level of glucose in the blood of animals.

At the level of the hypothalamus glucose modulates both basal secretion of luteinizing hormone and preovulatory release of this hormone. It also plays the role of the main source of energy for ovarian cells [8, 9]. It is shown that in highly productive dairy cows the concentration of glucose in the follicular fluid increases during the growth of follicles, and in the postnatal period the nature of changes in this concentration in the fluid of dominant follicles is similar to that in the blood [10]. This indicates a direct effect of glucose on the quality of sexual and somatic cells of antral follicles, the effectiveness of which depends on the state of energy balance in the body of animals. In addition, the effect of glucose can be indirect. Thus the content of this metabolite in the blood of cattle with a negative balance is proportional to the concentration of insulin and insulin-like growth factor I synthesized by the liver [11, 12]. In turn, both hormones serve as important modulators of viability and functional activity of ovarian follicles at all stages of their development, including preantral ones [7, 9, 13, 14]. Thus ovarian hypofunction may be associated with hypoglycemia in the examined cows.

The reason for the weakening of reproductive capacity of cows is also a decrease in the amount of fiber and an increase in acidic feed in the diet of animals. Fiber is necessary for the reproduction of cellulolytic bacteria which is an important component of microbial scar digestion. With its low content...
in the diet the duration of chewing gum is reduced that leads to a decrease in the production of saliva, a natural buffer. In the concentrated type of feeding, grain starch is actively used by the amylolytic microflora of the rumen for the synthesis of volatile fatty acids (acetic, butyric and propionic) and to a greater extent, lactic acid. In optimal digestion conditions it is almost completely processed by the scar microflora. In this case, volatile fatty acids are the main energy material and the source of lactose, milk fat and glucose.

However, with the constant flow of large amounts of lactic acid and other volatile fatty acids into the blood the liver can not metabolize them. Significant amounts of lactic acid in the blood, as well as excess content in the diets of canned feed (silage, haylage) rich in organic acids, leads to a shift in the pH of the rumen in the acidic stron. As a consequence it also leads to the development of chronic acidosis. Acidic environment is not favorable for the reproduction of scar microflora, utilizing lactic acid, at the same time it promotes the synthesis of lactobacilli producing lactate. As a result lactic acid accumulates in the scar fluid. Then it is absorbed into the blood and enters the liver. In addition high acidity irritates the mucous membrane of the scar and intestine, ulcers and erosion are formed. The barrier function of the mucous membrane is the synthesis of vitamins, the absorption of nutrients and minerals is disturbed [3]. Consequently, the change in the clinical status of cows was probably associated with a violation of the digestive processes in the event of metabolic acidosis.

As it is known, there is a close connection between protein, carbohydrate, mineral and other types of metabolism. The study of mineral metabolism in dairy cows showed a decrease in the amount of total calcium in the blood of animals, which is probably due to a lack of it in the food. A violation of absorption is clearly seen in the small intestine, increased secretion of the element with milk and excessive intake of phosphorus. Calcium is an indispensable component of the organism of ruminants, it is necessary for the normal functioning of the nervous tissue. It has an impact on the effectiveness of the hormones involved in the conversion of prothrombin to thrombin in the clotting of blood. It also maintains normal conditions in the cells to create the electrical potential on the cell surface. Calcium ions increase the protective functions of the body. They lower the membrane permeability to harmful substances and increase the phagocytic function of leukocytes. In combination with vitamin D calcium promotes the activation of cellulolytic bacteria in the rumen and reduces the time of fiber splitting [15].

4. Conclusion
In one of the breeding farms of the Perm region, some cows showed the preclinical stage of development of postpartum inflammatory processes in the uterus. The others cows showed the development of clinical metritis, which was associated with an excess of protein in the diet, a deficiency of glucose, calcium and vitamin D. The further use of unbalanced feed in the diet and non-compliance with zoohygienic requirements in the content of animals would lead to deterioration of the functional state of the body, decrease of milk productivity and also the reduction the period of commercial use of cattle.

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