Development and application of new methods of correction and prevention of metabolic diseases in Holstein cattle

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Abstract. The article presents data on the periods and main reasons for the retirement of highly productive Holstein cattle at dairy farms, and offers the production of improved therapeutic and preventive measures for metabolic disorders in cows.

1. Introduction
The progressive growth of intensification of dairy cattle breeding is closely related to the commissioning of advanced resource-saving technologies for feeding and keeping animals. The solution of this problem is facilitated by the construction of large dairy complexes with loose-box contents, equipped with modern equipment and high-performance machines. They allow you to automate labor-intensive processes and significantly increase labor productivity, guarantee more comfortable and less labor-intensive conditions for service personnel.

2. Materials and methods
The work was carried out at the Department of Animal Diseases and VSE of the Saratov State Agrarian University named after N.I. Vavilov, as well as in various farms of Saratov, Voronezh and Ryazan regions. The object of the study was the Holstein cows of European selection, aged from 2 to 7 years, with a productivity of 10 to 12 thousand kg of milk per year.

Information about the terms of use of cows, milk production, duration of lactation, past diseases, reasons for culling, forced slaughter, mortality, etc. was taken from a database of electronic herd management systems DairyPlan, DairyComp 305, Selex, journals and records of breeding records.

The parameters of the microclimate were set in the premises where the highly productive dairy cattle of the Holstein breed were kept. Temperature, humidity, air velocity in the room were determined using a Testo 435-2 device, illumination - with a Testo-540 luxmeter [1-6].

The obtained material was subjected to mathematical processing by methods of variation statistics using the Microsoft Excel 2016 program. The criterion of reliability was determined according to the Student's table.
3. Results
An analysis of the reasons for culling, carried out at 26 modern livestock farms, showed that the average duration of productive economic use of cows was 3.3 lactations, which is due to the premature culling of cows from the herd. To our knowledge, metabolic diseases are at the root of premature culling. As a result, the main reasons for leaving are gynecological diseases (28.4%), diseases of the udder (17.8%), digestive system (15%), hooves and injuries (13.2%), abomasum displacement (7.8%), diseases of the respiratory system (6.1%), liver diseases (4.8%), pathological parturitions (3.9%), postpartum paresis (2.8%) (figure 1).

![Figure 1. The main reasons for the retirement of cows at dairy complexes.](image)

The percentage of retired cows from the total number of fodder livestock should be indicated, depending on the duration of lactation:

- 0-30 days of lactation - 4.6%;
- 30-60 days of lactation - 6%;
- 60–90 days of lactation - 9.5%;
- 90-120 days of lactation - 13.7%;
- 120-150 days of lactation - 15.2%.

The percentage of first-calf cows retirement from the number of fodder cows was 2.5%, with the recommended indicator less than 0.9%. It is important to note that 10.6% of the animals left for the year did not reach 60 days of lactation.

Keeping lactating cows indoors during transition periods (at an air temperature in the barn from $10.9 \pm 0.09$ to $15.9 \pm 0.67 ^\circ C$, relative air humidity from $76.1 \pm 2.18$ to $86.1 \pm 1$, 85%) THI was 60–67, which is quite consistent with the optimal conditions of detention (table 1).

The light level should normally be 50–75 lux. However, there is no consensus on this issue in the scientific literature. Foreign scientists propose to increase the illumination in barns up to 150-200 lux, considering that the productivity of cows will increase by an average of 10-15%. The illumination index on average for the complexes varied from $29 \pm 2.3$ to $43.0 \pm 3.8$ lux, which does not contribute to an increase in milk productivity [7-12].

The excess of carbon dioxide concentrations up to $0.35-0.40 \pm 0.02\%$, at a rate of $0.25-0.27\%$, of ammonia, up to $0.08-0.1 \pm 0.02 mg / l$, at a rate of no more than $0.02 mg / l$ and hydrogen sulfide - up
to 0.01-0.15 ± 0.09 mg / l, at a rate no more than 0.005 mg / l. This has a negative effect on the nervous system of animals and causes general poisoning of the body.

Table 1. Average indicators of microclimate in premises with loose housing during transition periods (M ± m).

| Microclimate indicator | Current indicators                        | Recommended indicators |
|------------------------|-------------------------------------------|------------------------|
| Temperature, °C        | From +10.9±0.09 to +15.9±0.67             | From +8 to +16         |
| Relative humidity,%    | 76.1±2.18– 86.1±1.85                      | 50–85                  |
| THI Index              | 60–67                                     | <75                    |
| Illumination, lux      | 29±2.3–43.0±3.8                           | 150–200                |
| Air speed, m / s       | 0.34±0.05–0.5±0.01                        | 0.5                    |
| CO₂,%                  | 0.35–0.40±0.02                            | 0.25–0.27              |
| NH₃, mg / l            | 0.08–0.1±0.02                             | <0.02                  |
| H₂S, mg / l            | 0.01–0.15±0.09                            | <0.005                 |

The main task of the treatment was to restore the disturbed metabolic abnormalities in animals. These are fluid therapy, normalization of the acid-base state, restoration of mineral and vitamin metabolism, symptomatic therapy (table 2).

Table 2. Scheme of measures to correct metabolic disorders.

| 0 day | Drinking an energy cocktail |
|-------|-----------------------------|
| 1 – 10 day | Thermometry |
|       | Inspection in a "circle" |
| 1 – 5 day | Abomasum displacement diagnostics |
| 7 and 10 day | Drinking glycerin |
|       | Measuring the level of ketone bodies |

After calving, we recommend filling the rumen with a special cocktail. It contains propylene glycol - 300 ml, calcium propionate - 500 g, potassium chloride - 150 g, calcium chloride - 150 g, magnesium sulfate - 200 g, sodium phosphate - 200 g, dextrose - 300 g, vanillin - 20 g, yeast - 150 g. The resulting mixture must be diluted in 20 liters of warm water. Offer the animal to drink a cocktail on its own, if refusal, pour it through a drencher or probe.

For the treatment and prevention of metabolic diseases in the new period, we have developed protocols for the treatment of major diseases.

Protocol No. 1. Treatment of ketosis:
- Dexamethasone - 10 ml, once;
- Glucose solution 40% - 200 ml i.v., 3 days;
- Calcium borgluconate solution - 400 ml i.v., 3 days;
- Ringer-Locke's solution - 3000 ml, once;
- Propylene glycol inside - 600 ml, 3 days (provided that glycerin is not used in feeding).

Protocol No. 2. Treatment of acidosis:
- NaHCO₃ (baking soda) - 100–150 g per 1 liter of water, 2 times a day, 3 days;
- NaCl solution 10% i / v, dose depending on body weight and course of the disease.

Protocol No. 3. Treatment of postpartum paresis:
- Kalfoset - 100 ml, once;
- Caffeine-sodium benzoate 20% –15 ml s / c once.

Groups were formed according to the principle of analogs. In the experimental group, during the whole new period, the scheme for monitoring metabolic diseases developed by us was used. The second group was the control group; the standard scheme of metabolic prevention used in the household was used.

4. Discussion
In the experimental group, the incidence of displaced abomasum was 4.6%, which is 54.5% lower than in the control group (10.1%). The same trend was observed with the incidence of subclinical and clinical ketosis, acidosis, postpartum bedding and paresis in fresh cows (figure 2).

![Figure 2. The incidence of fresh cows in the experimental and control groups.](image)

The removal of fresh cows in the experimental group was 4%, in the control - 9% of the number of calves in 30 calendar days.

A decrease in the duration of diseases in the experimental groups was established, days: subclinical ketosis - up to 5.2 ± 1.1, clinical ketosis - up to 6.2 ± 1.08, acidosis - up to 4.3 ± 0.98, postpartum incubation - up to 1 , 2 ± 0.54.

The total gross milk yield for the first 30 days of lactation was 77 800 kg in the experimental group, and 60 060 kg in the control group. The average daily productivity of the experimental group was also higher for 0-14 and 15-30 days - 21.4 and 29.9 kg / day, respectively.

The economic effect was 193,134 rubles, and the effectiveness of veterinary measures per 1 ruble of costs was 2.25 rubles.

5. Conclusion
Thus, the following conclusions can be drawn:
- The average duration of productive economic use on the studied modern dairy complexes was 3.3 lactations, which is primarily due to the premature culling of cows from the herd. Metabolic diseases are at the root of premature culling.
- The technology of keeping animals at modern dairy complexes has a number of deviations from zoohygienic requirements, in particular, the illumination is 29 ± 2.3–43.0 ± 3.8 lux. There is an excess of the values of carbon dioxide concentrations up to 0.35-0.40 ± 0.02%, ammonia - up to 0.08-0.1 ± 0.02 mg / l and hydrogen sulfide - up to 0.01-0.15 ± 0 , 09 mg / l, which is explained by the insufficient level of air exchange, since the speed of air movement averages 0.34 ± 0.05-0.5 ± 0.01 m / s.
- In terms of production, the high efficiency of the application of the complex methods developed by us was confirmed, including drinking an energy cocktail, using a monitoring
scheme for fresh cows and a treatment regimen for the main diseases of the new period. As a result of the economic calculations carried out for each ruble spent on the provision of preventive and therapeutic measures, the farm receives 2.25 rubles arrived.

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