

The dynamics of blood composition is the main indicator of the adaptability of Holstein cattle to the conditions of the South of Russia

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Abstract. The article presents a comparative assessment of the dynamics of biochemical and hematological parameters of the blood of the black-and-white Holstein breed of the Dutch breeding in the conditions of a robotic farm for the first two lactation to establish the influence of climatic conditions on the adaptation process. It was found that, with the exception of the hemoglobin concentration (HGB), increases in the level of their content were noted for all other analyzed blood parameters, which indicates a different degree of overload experienced by animals in conditions of a sharp change in climatic conditions. It is quite natural that the climate, the feeding conditions, and the maintenance (composition and structure of the diet), although the level of feeding is quite high, cannot but affect the physiological state of the animals to varying degrees, which must be considered during operation.

1 Introduction

The climate of the Netherlands is temperate, with frequent cyclones, fogs, cloudy weather, often changing, sharply differs from the dry continental steppe zone of Kabardino-Balkaria with a long hot, mostly, without precipitation, summer and windy, snow-free winter period, which definitely cannot but have a certain negative impact [1].

At this stage, the new forms of management represented by agricultural organizations, peasant farms and individual entrepreneurs are characterized by relatively small sizes, with a limited number of animals and corresponding financial capabilities that do not allow either the purchase or maintenance (due to the lack of an appropriate feed base) of Holstein cattle. These factors force the maintenance of livestock of local breeds (Red Steppe and Schwyz, and their hybrids), with which practically no breeding work is carried out, the only advantage of which is the maximum adaptability to virtually year-round pasture maintenance with productivity 2.5-3 times lower than Holstein.

In the republic, herds of improved Red Steppe breed with a productivity of 6000-6700 kg with the technology of camp-pasture maintenance in the summer have been created,

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using red-mottled Holsteins, but this technology is not widely used. In such conditions, the study of the prospects for the introduction of robotic farms is important. Two farms are already successfully operating in the republic, and the work is devoted to the analysis of the herd of one of them.

Relevance. The issues of preserving and realizing the genetic potential of Holstein cattle, especially in the conditions of the steppe zone of South of Russia, are of great importance. This is a fairly extensive zone of the Southern and North Caucasian Federal Districts, the climatic parameters of which are radically different from the breeding zone of this breed [2-4]. Under these conditions, a systematic study and timely analysis of the physiological state of animals will allow to identify possible causes of discomfort and exclude them from the maintenance technology in time [5, 6].

The purpose of the research is to study the nature of the variability of metabolic processes in the dynamics of the main blood parameters and their impact on the adaptation process.

2 Material and methods of research

The conditions of blood collection and its delivery to the laboratory, the technique of blood collection, the time of day, the place of puncture, the tools used, the age and physiological state of the animal's body are important for obtaining reliable results.

Blood sampling was performed early in the morning before feeding from cows of the Holstein breed of the Dutch breeding at the robotic farm - the Kupshinov farm in the Prokhladnensky district. Fig. 1.

All cows were included in the sample, with the exception of dry cows and cows of the calving pen (cows are in the calving pen during the first 20 days of lactation after calving).

Modern vacuum tubes with a trilon, needle holders and double-sided needles were used for blood sampling. Blood was taken from the tail vein in compliance with all the rules of veterinary sanitation and hygiene.

The blood test was carried out in the laboratory of molecular selection and biotechnology of the KBSC RAS on the hematological analyzer "Gemalite 1270" for 21 indicators of blood composition (Certificate of registration dated September 17, 2019, No. 009580) Fig. 2.



Fig. 1. Blood drawing from the caudal vein.



Fig. 2. Hematological analyzer "Gemalite" 1270".

The received data were processed biometrically (DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip-0, Program: BIOMETR).

Table 2. The main hematological indicators of blood in black-and-white Holstein cows imported from the Kingdom of the Netherlands to Kabardino-Balkaria (2019 compared to 2020) LLC "Worker".

Indicator	Average daily milk yield			WBC			Lim, %			Gran, %		
	2019	2020	dif.	2019	2020	dif.	2019	2020	dif.	2019	2020	dif.
The highest indicator	35.6	53.0	+17.4	24.28	38.53	+14.25	18.23	26.25	+8.05	7.14	11.43	+4.29
Minimal	8.6	7.3	-1.3	8.6	4.34	-4.26	4.34	1.08	-3.26	2.32	1.55	-0.77
Difference	27.0	45.7	+18.7	15.68	34.19	+18.51	13.89	25.20	+11.31	4.82	9.88	+5.06
SIGMA (δ)	5.25	13.90	+8.65	3.65	4.85	+1.20	3.196	4.16	+0.96	1.095	2.08	+0.985
Error of the average arithmetic. (mx)	0.84	1.50	+0.66	0.51	0.55	+0.04	0.447	0.477	+0.010	0.153	0.238	+0.85
Variation coefficient, (Cv)	24.1	59.01	+34.91	25.8	37.76	+11.96	35.47	64.29	+28.82	26.476	42.47	+15.99
The highest indicator	21.8	22.2	+0.4	14.18	12.84	-1.34	9.013	6.48	-2.53	4.138	4.93	+0.792

Continue Table 1.

Mid %			RBC			HGB			HCT			MCV			MCH		
2.38	5.55	+3.17	7.59	7.64	+0.05	129	118	-1	0.383	0.386	+0.003	54.5	57.5	+3.0	19.2	19.9	+0.7
0.47	0.42	-0.05	4.65	4.30	-0.35	81	72	-9	0.242	0.224	-0.018	44.3	45.0	+0.7	14.2	13.0	-1.2
1.91	5.13	+3.22	2.94	3.34	+0.40	48	46	-2	0.141	0.162	+0.021	10.2	12.5	+2.3	5.0	6.9	+1.9
0.52	0.80	+0.28	0.62	0.74	+0.12	9.37	8.69	-0.68	0.030	0.030	0.000	2.451	2.62	+0.17	1.216	1.32	+0.10
0.073	0.08	-0.0053	0.08	0.08	0	1.31	0.99	-0.32	0.04	0.03	+0.001	0.346	0.300	-0.046	0.172	0.152	-0.20
0.439	56.50	+12.6	10.11	11.73	+1.62	9.25	9.06	-0.19	10.9	10.64	+0.55	4.975	5.32	+0.34	7.375	8.74	+1.36
1.189	1.420	+0.231	6.16	6.35	+0.19	101.28	95.90	-5.38	0.303	0.312	+0.009	49.27	49.30	+0.03	16.49	15.18	-1.31

3 Results of the study and their discussion.

The main indicator that characterizes the processes of vital activity in the body of animals is blood, which comes into contact with the cells of all tissues and organs, thus providing the possibility of their nutrition and respiration. Therefore, the blood components reflect not only the state of health of the body, its relative homeostasis, but also its productive qualities [7].

The analysis of the dynamics of 9 main blood parameters (Table 1) shows that, with the exception of the absolute number of white blood cells (WBC) and lymphocytes (Lim), the hemoglobin concentration (HGB) and the average hemoglobin content in red blood cells (MCH), which decreased by 9.4, 28.1, 5.31 and 7.94%, respectively, with age and the adaptation period, there was a tendency to increase the average values for all other analyzed

indicators. Attention is immediately drawn to the fact of a more than twofold increase in the variability of this indicator from 24.1 to 59.0% and, accordingly, a change in the extreme indicators of daily milk yield. Since all the dairy livestock were in the same conditions, in the same pen, and practically did not differ much in age, nevertheless, it is impossible to exclude the influence of environmental elements in the conditions of a robotic (one unit) farm. In this case, the possibility of grouping cows both by the amount of milk yield, respectively, and feeding standards is excluded.

According to the results of studies, the absolute number of white blood cells in the blood (WBC) tends to decrease, but on average it has only approached the upper limit of the norm, amounting to 12.84 (with a norm of 9.1, fluctuations of 4.5-12.0 thousand/ μ l.), while the variability of this indicator has increased from 25.8 to 37.8%, which indicates the continuation of the adaptation process. The same situation is observed for lymphocytes (Lim), the average content of which has decreased from 9.01 to 6.48, which indicates a certain stabilization, but the variability has almost doubled, from 35.5 to 64.3 percent, which also confirms the complexity of the adaptation process.

The content of granulocytes, which provide an antibacterial immune response of the body, increased by 19.1 % (from 4,138 to 4,930), and the variability of their indicators increased from 26.5 to 42.5 %, which also indicates complex metabolic processes in animals. To a certain extent, this is evidenced by an increase in the absolute number of average cells and red blood cells, although their indicators are within the physiological norm.

The concentration of hemoglobin decreased slightly with age, but it also remained within the normal range and was virtually the same in all animals. Such indicators as the hematocrit (HCT), the mean cell volume (MCV) and the average hemoglobin content in the red blood cell remained practically stable.

It is important to indicate that there is a certain stability in these indicators.

4 Conclusions

In conclusion, it can be noted that the composition and ratio of the main blood elements, as in a mirror, reflects the "well-being" of imported animals and, of course, the results of research for the first years cannot be stable enough, even a change of one generation is not enough for this, but it makes it possible to establish in which direction and by what methods it is possible to help to preserve the livestock without significant rejection.

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