



CLINICAL, PHYSIOLOGICAL AND REPRODUCTIVE CHARACTERISTICS OF CATTLE

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ABSTRACT

This article presents the results of the research of clinical and physiological indicators in cattle of the Hereford and North American Aberdeen Angus breeds during their acclimatization to the semi-desert climate of West Kazakhstan. The research has been carried out to analyze the climatic conditions under which animals are kept in North Dakota (USA) and on farms in West Kazakhstan. The clinical, physiological and reproductive characteristics of cattle have been studied under the new breeding conditions taking into account the seasons of the year. The coefficients of adaptation, tolerance, thermal stability, as well as heat resistance indices characterizing the adaptability of animals to high and low temperatures in the sharp continental climate of West Kazakhstan have been analyzed. All of the above-mentioned indicators have been compared with those of the Kazakh Whiteheaded breed.

Keywords: Cattle, Hereford Breed, Aberdeen Angus Breed, Kazakh Whiteheaded Breed.

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1. INTRODUCTION

This research is topical because, currently, in order to increase the production of high-quality beef, along with the expansion of the specialized cattle population in the Republic of Kazakhstan, beef cattle is being imported. The Hereford and Aberdeen Angus breeds are the most numerous among foreign cattle, having a share of 14.4 % on farms in the West Kazakhstan region. The need to study the acclimatization of different breeds arises due to, first of all, certain differences in the environmental and climatic conditions of the places of

their initial selection, and those of the places of their further breeding. Sometimes, in case of severe acclimatization of animals, the breed selection program has to be adjusted in order to preserve the gene pool of the cattle imported to Kazakhstan.

Currently, both the Republic of Kazakhstan and the Russian Federation are importing breeding stock. The scientists [1, 2] unanimously note that such a large event requires a preliminary detailed study taking into account its efficiency, availability of production facilities and fodder, as well as human resources and infrastructure. According to academician A.V. Cherekaev [3], adaptation is the first phase of animals' acclimatization when natural selection prevails over artificial selection. In the course of adaptation, animals get accustomed to the new conditions under which they are fed and kept, the new environment, premises, people and animals, as well as the new daily routine.

2. MATERIALS AND METHODS

The research focused on the 4-year-old cows and bulls of the Hereford, Aberdeen Angus and Kazakh Whiteheaded breeds kept under the same climatic and feeding conditions, in the same soil and plant environment using similar feeding and maintenance technology elements implemented in specialized beef farming.

The acclimatization indicators of foreign cattle breeds were studied in the autumn of 2017 and in the winter, spring, and summer of 2018 based on the method studying the clinical indicators of acclimatization in foreign cattle breeds. Temperature and relative humidity were measured with a psychrometer during the measurement of clinical indicators. The clinical and physiological parameters were studied by conventional methods for bulls ($n = 5$) and cows ($n = 5$) separately. The animals' body temperature, respiratory rate, and heart rate were measured three times a day at 07.00 – 08.00, 14.00 – 15.00, and 20.00 – 21.00, in two adjacent days of the year. The adaptive capacity was calculated based on the clinical data: adaptability coefficient, tolerance coefficient, heat tolerance coefficient, heat resistance index and cold resistance index.

The reproductive ability of the 4-year-old cows was determined based on their service periods, conception rate followed by serving by stud bulls only in the Kazakh Whiteheaded breed cows, fertilization rate, intercalving interval, and calf crop.

The research was carried out at the Musa Farm breeding Hereford and Aberdeen Angus cattle, and at the Hafiz Farm breeding Kazakh Whiteheaded cattle in the Zhanakala District of the West Kazakhstan Region. The farms are known as nuclei. The animals were imported in late 2013 and early 2014.

The climatic conditions in the state of Dakota (USA) and in the semi-desert zone of West Kazakhstan, under which the cattle were kept, were studied based on an Internet resource providing data about the climatic conditions in these countries, as well as the authors' own scientific observations and analysis of the results.

3. RESULTS

According to the Internet, the climate in North Dakota (USA) is continental characterized by hot summers and cold winters. The highest temperature is 49°C , and the lowest temperature is -51°C . The average temperature in January ranges from -8 to -16°C , and in July it ranges from 18 to 24°C . The average precipitation varies from 220 to 560 mm.

At -30°C , the animals lay on the snow calmly; a three-wall shelter was made for them. The grazing season was from May to November. The pastures had been gradually sown with perennial grasses for 3 years. For protection from winds, the areas where animals were kept in

winter (from November to April) were equipped with windproof constructions: natural terrain, windproof fences, stacks of hay bales and straw.

In the West Kazakhstan region, the average air temperature over the past seven years had been -9.97°C in winter and +23.3°C in summer. The average annual precipitation had been 338.1 mm. Based on the above-mentioned data, one may note that the temperatures in different seasons of the year and average precipitation do not differ much in the regions of the two countries under consideration, which, to some extent, may imply a mild acclimatization of foreign cattle.

The farms where the scientific and economic research was carried out applied early-spring calving. The grazing season was from April to December 10. In the winter housing season, the diet included locally grown mixed-grass hay and a mixture of concentrated feeds. The cattle were pastured on several typical steppe lands covered mainly with mixed herbs and Volga fescue along with feather grass; the semi-desert lands were covered mainly with Volga fescue and Artemisia.

It should be noted that during the breeding of foreign cattle, the farm took into account the negative factors of acclimatization and adaptation to the new conditions, as well as the more sensitive response of animals of chain genotypes to the environmental factors.

The research shows that the animals' body temperature, their respiratory rate and heart rate are within physiological norms (Table 1).

Table 1 Physiological indicators of animals with different genotypes. ($\bar{X} \pm S_x$)

Breed	Groups	n	Clinical indicators		
			Body temperature, °C	Frequency of respiratory movements	Pulse rate
Autumn (t = 15°C)					
Hereford	Bulls	5	38.1 ± 2.33	21.4 ± 0.70	54.4 ± 2.15
	Cows	5	37.7 ± 1.15	27.2 ± 0.20	61.8 ± 1.41
Aberdeen Angus	Bulls	5	38.2 ± 2.15	19.8 ± 1.30	58.8 ± 1.08
	Cows	5	37.8 ± 1.20	23.0 ± 0.86	63.4 ± 2.48
Kazakh Whiteheaded	Bulls	5	37.6 ± 0.78	21.6 ± 0.30	55.8 ± 2.79
	Cows	5	37.4 ± 2.12	24.5 ± 2.30	65.8 ± 1.95
Winter (t = -21°C)					
Hereford	Bulls	5	38.6 ± 1.01	12.2 ± 0.3	59.2 ± 2.6
	Cows	5	38.1 ± 0.30	12.4 ± 0.3	70.0 ± 2.9
Aberdeen Angus	Bulls	5	38.5 ± 1.21	12.8 ± 0.6	69.6 ± 1.1
	Cows	5	37.9 ± 0.73	13.2 ± 0.3	72.4 ± 1.3
Kazakh Whiteheaded	Bulls	5	38.1 ± 1.83	11.8 ± 1.3	68.4 ± 1.5
	Cows	5	38.2 ± 0.60	12.4 ± 0.9	71.7 ± 1.4
Spring (t = 17°C)					
Hereford	Bulls	5	38.9 ± 0.3	17.4 ± 1.35	58.2 ± 1.70
	Cows	5	38.2 ± 1.2	20.8 ± 1.80	65.4 ± 0.62
Aberdeen Angus	Bulls	5	38.3 ± 0.6	18.2 ± 0.30	62.0 ± 1.32
	Cows	5	38.1 ± 0.3	21.6 ± 2.19	64.8 ± 2.71
Kazakh Whiteheaded	Bulls	5	38.3 ± 2.1	18.0 ± 2.70	62.7 ± 0.83
	Cows	5	38.7 ± 0.6	20.4 ± 1.45	65.4 ± 1.75
Summer (t = 30°C)					
Hereford	Bulls	5	38.5 ± 0.3	24.0 ±	77.6 ±
	Cows	5	39.2 ± 1.2	23.4 ±	74.2 ±
Aberdeen Angus	Bulls	5	38.7 ± 0.6	25.6 ±	78.6 ±
	Cows	5	38.6 ± 0.3	24.6 ±	75.2 ±
Kazakh Whiteheaded	Bulls	5	39.1 ± 2.1	23.1 ±	77.2 ±
	Cows	5	39.1 ± 0.6	24.7 ±	73.4 ±

It should be noted that there were no significant differences in the clinical and physiological indicators in different seasons of the year, which implied a generally good acclimatization of the foreign animals to the local climatic conditions.

The calculations showed that all the genotypes had positive adaptability coefficients. It is believed that the smaller the adaptability coefficient was, the more adapted the animals were. Some authors believe that good adaptive capacity implies that values should decrease from 2. In this case, the adaptability coefficient values were not very high because the animals had been brought from a foreign area having a similar climate – sharp continental – which was why there were no drastic stress responses to the changes in the living conditions.

It should be noted that the values of all the indicators (tolerance coefficient, adaptability coefficient, heat resistance index) were optimal in terms of acclimatization of the foreign cattle. The foreign cattle had high tolerance coefficients both in winter and summer, which testified to good acclimatization of the Hereford and Aberdeen Angus cattle to the environmental changes. The heat resistance indices of the Hereford and Kazakh Whiteheaded breeds were higher than those of the Aberdeen Angus breed, which indicated their better resistance to high ambient temperatures.

The reproductive ability of cows was largely determined by the breed features, as well as the environmental and climatic conditions of their breeding area [4-6].

The main indicator characterizing the reproductive ability of beef cows was their intercalving interval, which was influenced by all reproductive disorders which they suffered from.

Table 2 Comparative data of reproductive ability of different cow breeds

Breed	n	Duration of period, days			Fertility, %	Conception rate	Calf crop, %
		Pregnancy	Service period	Intercalving			
Hereford	120	285.0 ± 1.23	67.3 ± 1.34	351.3 ± 1.41	98.3	-	83.4
Aberdeen Angus	383	284.4 ± 1.45	67.5 ± 1.14	351.9 ± 1.33	97.2	-	82.0
Kazakh Whiteheaded	275	283.2 ± 1.23	65.0 ± 1.73	346.8 ± 1.98	-	1.4 ± 0.34	85.3

Table 2 shows that the Kazakh Whiteheaded cows had the shortest intercalving interval (346.8 days), and the Hereford and Aberdeen Angus cows had the highest one (351.3 and 351.9 days, respectively). This difference compared with the Hereford cows was close to the significance of the first level of probability for a large number of observations (1.61), and in case of the Aberdeen Angus cows, the differences were significant ($P > 0.95$).

As artificial insemination was not used on the farm, the fertility of the Hereford and Aberdeen Angus cows was determined by the number of the cows fertilized during the breeding season. For the Kazakh Whiteheaded cows in which artificial insemination was applied, the conception rate was determined.

The average fertilization rate of the Hereford and Aberdin Anguss cows was 97.75 %, which was economically unjustified for beef farming.

The conception rate reflecting the number of inseminations necessary for the fertilization of the Kazakh Whiteheaded cows was within the permissible range [7, 8].

A slight advantage in the duration of the service period was noted in the Kazakh Whiteheaded cows ($P < 0.95$).

The calf crop reflects not only the economic value, but also characterizes the cows' reproductive ability to a certain extent. The Kazakh Whiteheaded cows had the highest calf crop with a difference of 1.9 and 3.3 % compared to their Hereford and Aberdeen Angus peers, respectively.

4. CONCLUSION

In general, the animals of all the genotypes were characterized by quite good reproductive qualities, with the Kazakh Whiteheaded breed having a slight advantage.

The clinical and physiological indicators of all the genotypes did not have any significant differences. At the same time, the adaptive capacity indicators show that the Hereford and Aberdeen Angus cattle are characterized by adaptive flexibility and good acclimatization to the sharp continental conditions typical of the semi-desert zone of West Kazakhstan.

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