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FEATURES OF HEART ACTIVITY OF CATTLE IN THE CONDITIONS OF SOUTHERN ARAL SEA REGION

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ABSTRACT

In this article the results of comparative analysis of electrocardiogram are shown for the cows of different breeds in Aral Sea region. It is set that the high temperature of environment and sunny insolation render negative influence on the functional parameters of the cardiac vascular system of animals. There are facts about the cows of different breeds at influence of different temperatures have unidirectional functional changes in the operation of heart. At the same time, we will mark that these changes are less expressed for the cows of the improved zebu visible cattle, what for the cows of delivery breeds.

Keywords: Aral Sea region, electrocardiogram, environment, cardiac vascular system of animals, sunny insolation.

Introduction

Recently, the development of livestock farming on an industrial basis requires the creation of optimal conditions for animals, taking into account physiological standards and improving the veterinary service system. The functional state of the cardiovascular system of animals is one of the main physiological indicators by which one can judge the nature of the influence of the environment on the body.

To clarify the features of the functional state of calves from birth and during the first six months of life, it is necessary to study the dynamics of the functional activity of the heart and the main vegetative functions in the age aspects, as well as to identify age-related and pedigree changes in the regulation of these functions in the Republic of Karakalpakstan. Individual adaptation is a process developing in

the course of life, as a result of which the body acquires resistance to environmental factors and gets the opportunity to live in conditions previously not suitable for life [2, 8].

Electrocardiographic studies in animals, in particular in cattle, are of interest not only from the point of view of comparative cardiology, they are necessary in connection with the analysis of cardiac activity in both veterinary practice and physiological and zootechnical experiments. The need to study the physiological adaptation of cows, calves and other animals to new conditions of keeping and feeding, the influence of high temperature and solar radiation of pain stimuli and stress factors on the body is one of the urgent problems of modern physiological science [2], [3], [11], [12], [13], [14], [15], [16], [17], [18], [19].

The research of the physiological mechanisms of regulation and the conditions for increasing the intensity of metabolic processes allows using the biological potential of the animal organism with the greatest efficiency. Any change in animal living conditions is directly and indirectly associated with a change in energy balance. Only by studying all aspects of the external impact on the body and adaptation to them, it is possible to identify the degree of the functional state of animals in a specific environment.

Material and methods.

The work was performed in the period from 2000 - 2017. The number of animals in the groups was selected depending on the objectives of the experiments and the variability of the characters. To increase the productivity of cattle, it is necessary to study the physiological mechanisms of adaptation of imported pedigree animals to the extreme conditions of the South Aral region (Republic of Karakalpakstan).

The research was conducted on cows of various breeds (black-motley, brown Latvian, zebuvid) on the territory of farms in Nukus, Kegaili, Chimbay regions of the Republic of Karakalpakstan. The age of the experimental cows was 5-6 years. The live weight of cows of black-steppe breed is 470-580 kg., brown Latvian breed 454-470 kg., Zebuvid breed - 425-435 kg..

Assessment of cardiac activity was carried out on the basis of electrocardiographic (ECG) studies of animals. ECG was recorded in the frontal and sagittal projections according to the method of Roshchevsky (1958, 1960) [9], [10] and Mezentseva (2014) [5], [6]. The pulse rate, the duration of the ECG intervals, the arrhythmia coefficient, axonometric data were taken into account. The material was processed by statistical methods [4], [7], [20], [21], [22], [23], [24].

Results and its discussion.

As a result of anthropogenic impact, which led to a reduction in the Aral Sea, an increase in the processes of aridization of the region's ecosystems, the area of productive plant communities is reduced, as a result of which the natural potential of pastures decreases, which negatively affects the development of animal husbandry. The environmental situation in the region requires a comprehensive study and development of scientifically based proposals for protecting animals from exposure to high temperature and solar radiation, which cannot be done without studying adaptation mechanisms [25], [26], [27], [28], [29].

The functional state of the cardiovascular system of animals is one of the main physiological indicators by which one can judge the nature of the influence of the environment on the body.

Maintaining the adaptive potential of the body under the conditions of intense exposure to various anthropogenic factors is one of the central problems of ecology and physiology. Individual adaptation is a process developing in the course of life, as a result of which the body acquires resistance to environmental factors and gets the opportunity to live in conditions previously not suitable for life.

Electrocardiographic studies in animals, in particular in cattle, are of interest not only from the point of view of comparative cardiology, they are necessary in connection with the analysis of cardiac activity in both veterinary practice and physiological and zootechnical experiments.

The nature of the electrocardiographic curve is determined not only by the age of the animal, the influence of pregnancy, lactation, but to a large extent by the

influence of the external environment (temperature, humidity, air, daily seasonal cyclicality of meteorological factors), conditions of feeding and feeding.

To increase the productivity of cattle, it is necessary to study the physiological mechanisms of adaptation of imported pedigree animals to the extreme conditions of the Republic of Karakalpakstan.

The research of electrocardiograms in cows were carried out under the influence of air temperatures of varying intensity and duration (18-43⁰C) and solar radiation from 2065-3396 kJ (h-m²). For the initial temperature (optimal) of the environment was taken 18-20⁰C.

The results of the research showed a specific feature of the adaptive reaction of the cardiovascular system to the temperature factor in cows of different breeds.

Experimental data show that at an air temperature of 18-20⁰C in zebu cattle the heart rate was 57.69 ± 2.32 beats / min., in black-motley breed - 61.78 ± 2.14 beat/ min., and in brown Latvian rocks 59.94 ± 2.27 bpm. With an increase in air temperature up to 36-40⁰C, this indicator increased by 14.3% in black-motley cows and by 11.4% in brown Latvian cows ($p < 0.05$). With a further increase in air temperature to 41-43⁰C, in the black-and-white breed, heart rate increased by 12.6%, in brown Latvian breed, respectively, by 16.4% ($p < 0.05$) (Fig. 1).

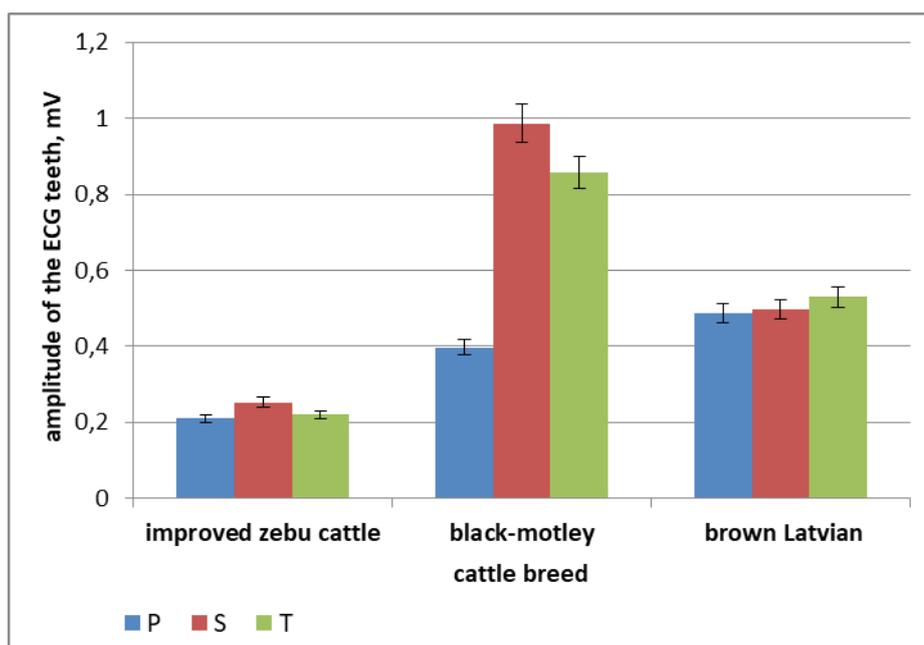


Fig. 1. Indicators of the magnitude of the vectors P, S, T B in sagittal projections according to axonometry in cows of various breeds at $t = 18-20^{\circ}\text{C}$

The analysis of the R-R cycle duration showed that at an ambient temperature of 18-20⁰ C in zebu cattle this indicator is 1.047 ± 0.089 s, while in black-motley breed and brown Latvian breed, respectively, 0.982 ± 0.071 and 1.001 ± 0.062 s. With an increase in air temperature to 40-43⁰C compared with zebu cattle, the duration of the R-R cycle in black-motley breed decreased by 16.3%, and in brown Latvian breed by 14.4% ($p < 0.05$).

The diastolic phase TP in the studied breeds at a temperature of 18-20⁰C was: for zebu cattle 0.321 ± 0.041 s, and for black-motley and brown Latvian breeds, respectively: 0.360 ± 0.41 s and 0.310 ± 0.039 s. With an increase in air temperature to 43⁰C compared with the improved type of zebu cattle, this indicator decreased by 14.5% in black-motley breed, and by 13.0% in brown Latvian breed ($p < 0.05$). At a temperature of 18-20⁰C, the time of electric systole (Q-T) for zebu cattle was 0.472 ± 0.054 s, and black-mottled and brown Latvian breeds were 0.430 ± 0.027 s and 0.469 ± 0.027 s, respectively.

The analysis of the R-R cycle duration showed that at an ambient temperature of 30-35⁰C for zebu-cattle this indicator is 1.047 ± 0.089 s., And for black-motley breed and brown Latvian breed, respectively 0.982 ± 0.071 and 1.001 ± 0.062 s. With an increase in air temperature up to 40-43⁰C compared with zebu cattle, the duration of the R-R cycle in black-motley breed decreased by 16.3%, and in brown Latvian breed by 14.4% ($p < 0.05$).

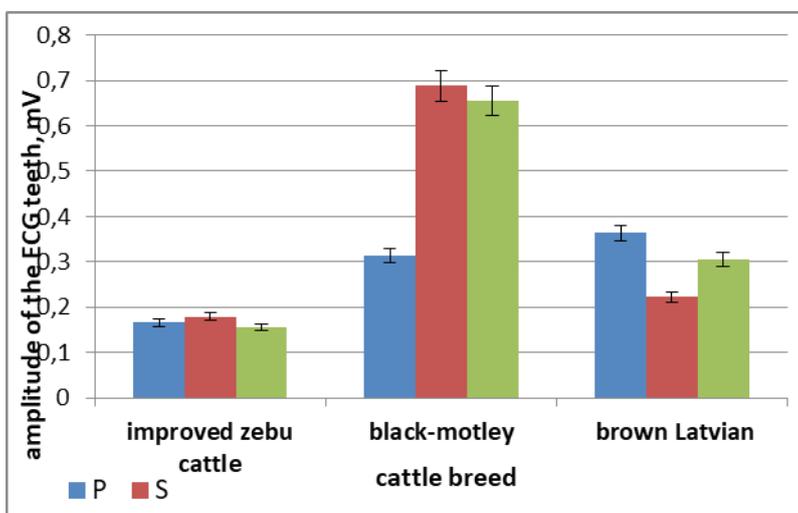


Fig. 2. Indicators of the magnitude of the vectors P, S, T B in sagittal projections according to axonometry in cows of various breeds at t=30-35⁰C

With an increase in temperature to 43°C, this indicator in improved zebu cattle decreased by 25.9%, in black and white breed by 28.7% and in brown Latvian breed by 22.4% ($p < 0.05$). According to axonometric data, our electrocardiograms of cows of different breeds with different degrees of heat resistance to high air temperature (40-43°C) and solar insolation are characterized by different values of the vectors P, S, T in sagittal projections (Fig. 3).

As can be seen from Fig. 3, in cows of black-motley and brown Latvian breeds, with an increase in air temperature (40-43°C), the value of the vector P in the sagittal projection decreased to 0.118 ± 0.010 and 0.120 ± 0.0114 mV, respectively, and the vector T to 0.212 ± 0.29 and 0.301 ± 0.065 mV, as well as the vector S, respectively, up to 0.558 ± 0.079 and 0.543 ± 0.048 mV. It should be noted that under such experimental conditions, the ECG indices of zebu cattle are characterized by smaller changes in the magnitude of the vectors compared with imported breeds of animals.

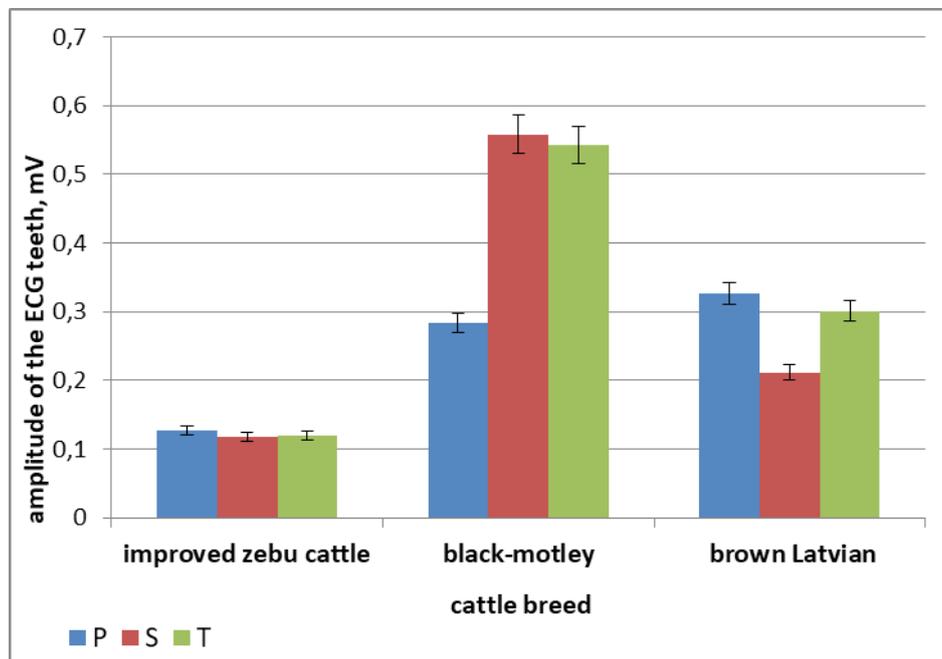


Fig. 3. Indicators of the magnitude of the vectors P, S, T B in sagittal projections according to axonometric data for cows of various breeds at $t = 40-43^{\circ}\text{C}$

The conducted studies allowed us to trace the pedigree feature of the bioelectric activity of the heart in cows of different breeds at different temperature ranges, as well as to establish the pattern of these changes.

Under these conditions, the autonomic nervous system, the sympathetic and parasympathetic departments, which constantly interact and adapt the organism to extreme environmental conditions, play an important role in the relationship between the organism of a pregnant cow and external environmental conditions and adaptive reactions of the body. The sympathetic department provides emergency mobilization of energy and plastic reserves during sharp changes in temperature and other climatic factors, by activating the nervous and humoral mechanisms.

Activation leads to increased cardiac activity, increased metabolism and increased muscle tone. At the same time, the parasympathetic effect provides a state of rest, stimulates anabolism, deposition of substances and energy conservation, weakening of cardiac activity [2].

The cardiovascular system in the animal's body provides metabolism through constant circulation of blood and lymph through its vessels, which play the role of liquid transport. With its help of blood circulation, there is an uninterrupted supply of oxygen, nutrients, water to the cells and body tissues of the body, absorbed into the blood or lymph through the walls of the respiratory and digestive apparatus, and the release of carbon dioxide and other end-products that are harmful to the body.

Hormones, antibodies, and other physiologically active substances are transported with blood, as a result of which the activity of the immune system and hormonal regulation of the processes occurring in the body with the leading role of the nervous system are carried out. Blood circulation - the most important factor in adapting the body to changing conditions of the external and internal environment - plays a leading role in maintaining its homeostasis (constancy of the composition and properties of the body). Disruption of blood circulation primarily leads to metabolic disorders and functional functions of organs throughout the body [3].

The heart rhythm is sensitive to any changes in the internal environment of the body and signals from the outside, reflects the state of regulatory systems in the body, the balance between the sympathetic and parasympathetic parts of the autonomic nervous system.

Under optimal environmental conditions, there is a "relative equilibrium" between the tones of these two departments. When the tone of one of them prevails, the tone of the other decreases. Despite the apparent antagonism of these two departments, their interaction allows the body to effectively regulate the activity of internal organs and systems. At the same time, activation of the departments may indicate a dysregulation of functions and a decrease in the adaptive capabilities of the body.

Our studies have shown that one of the important conditions for the adaptation of the animal organism to environmental changes is the effective regulation of the circulatory system and, in particular, the hemodynamic performance of the heart. Adaptation of the body as a whole and its energy dynamics in particular, as well as the mechanisms of thermoregulation provide balancing of the body to various ambient temperatures. Particular interest in this regard are animal organisms that are capable of wide adaptation to various environmental factors, where the temperature factor plays a significant role in the process of their life, since it is the main gradient in the speed of metabolic processes.

Thus, the temperature reaction depends on age, breed, feeding, productivity, acclimatization of the animal, as well as on climatic factors. Exposure to high temperatures can be a strong stressing factor, leading to decreased productivity, systematic functional disorders predisposing to the development of various diseases. The response of the body depends on the strength and duration of exposure, can lead to both negative and positive consequences. Irritants of sufficient strength cause the development of a stress reaction in the body, which negatively affects the physiological state. Impacts of lesser force cause the

development of antistress reactions - conditions preceding stress that increase natural resistance.

When the temperature of the environment rises, the cow has an equalization of heart rhythm while enhancing the activity of the sympathetic part of the autonomic nervous system. At the same time, the sympathetic part of the autonomic nervous system predominates in the vegetative balance, which is accompanied by tension in the body's regulatory systems responsible for maintaining temperature homeostasis. This indicates that the sharply continental climate and high temperatures in summer are a strong stress factor for cows that adversely affects the functioning of the cardiovascular system in animals.

Thus, in cows of various breeds, when exposed to different temperatures, unidirectional functional changes in the activity of the heart occur. At the same time, we note that these changes are less pronounced in cows of improved zebuvid cattle than in cows of imported breeds (black-motley, brown Latvian). Under these conditions, the autonomic nervous system, the sympathetic and parasympathetic departments, which constantly interact and adapt the organism to extreme environmental conditions, play an important role in the relationship between the organism of a pregnant cow and external environmental conditions and adaptive reactions of the body.

Conclusions.

1. It has been shown that in the cows studied by us, under the influence of various temperatures, unidirectional functional changes in the activity of the heart occur. These changes are less pronounced in cows of improved zebuvid cattle than in imported cows (black-motley, brown Latvian).

2. It has been established that the autonomic nervous system, the sympathetic and parasympathetic departments, which constantly interact and adapt the organism to the extreme environmental conditions of the South Aral Sea region, belong to the adaptive reactions of the body.

3. For the purpose of timely selection of highly productive cattle breeds, it is recommended, along with other methods, to apply an examination to study the

effect of the load on the cardiovascular system. When analyzing the data obtained, it is recommended to pay special attention to the reaction of the cardiovascular system to a stressing factor (exposure to high temperatures).

4. In farms (livestock production) of the Republic of Karakalpakstan in the hot season to protect cattle from overheating and heat stress, it is recommended to organize camp keeping with grazing animals in the cool part of the day on pastures.

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