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THE ADAPTATION OF ANIMALS TO BREEDING IN CERTAIN ECOLOGICAL CONDITIONS

[1,2]Gogaev O.K., [1]Vaniev A. G., [1]Tukfatulin, G.S., [1]Godzhiev, R.S., [1]Kadieva T.A., [1]Karaeva Z.A., [1]Tokhtieva E.A.

[1]Gorsky State Agrarian University, 362040, Russian Federation, Vladikavkaz, 37 Kirov Street, texmen2@mail.ru;, [2]North Caucasian Research Institute of Mountain and Piedmont Agriculture - the Affiliate of Vladikavkaz Scientific Centre of the Russian Academy of Science, 363110, 1 Williams Str., Mihkailovskoe vil., Republic of North Ossetia – Alania;

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Abstract:

The main indicators of gas-energy exchange allow us to speak about the general laws of functional transformations in the process of growth, development of the organism and animals' adaptation to certain environmental conditions. The experimental part of the study was carried out in the foothill zone of the North Caucasus. The heifers of Swiss and Kalmyk breeds were the object of the study. Their respiration rate was the lowest in winter and the highest in spring, regardless of the breed. This can be explained by the fact that in autumn the animals were before calving. The increased respiration and the decrease in its depth by 1,99 ml during summer were also due to that fact. The value of pulmonary ventilation in summer was 0,207 l / kg, approximately at this level it remained in autumn (0,195 l), but it sharply decreased by 39,9% in winter, and till spring it increased by 9,4 %. The exchange of gas of Kalmyk breed heifers was almost the same in summer and autumn, but in winter it decreased, then in spring it increased again. Its highest level was reached in autumn, it was 0,208 liters, and the lowest level was in winter-0,158 liters. The reaction of Swiss and Kalmyk bred heifers on environmental changes was different. In summer there was an increase in gas exchange and heat production in animals of both groups. The changes in environmental conditions associated with seasons have a significant impact on the body of animals and cause shifts in their gas exchange. Seasonal changes in the level of gas-energy exchange are related to different breeds of animals, at that time, the level of gas exchange was largely influenced by the productivity of animals and the nature of seasonal feeding. At the same time the animals of Kalmyk breed were less susceptible to stressful situations associated with the change of the season.

Key words: *gas-energy exchange, Swiss breed, Kalmyk breed, adaptation, respiratory rate, respiratory coefficient, heat production, ventilation.*

Corresponding author:

Gogaev O.K,

Gorsky State Agrarian University, 362040, Russian Federation, Vladikavkaz, 37 Kirov Street, texmen2@mail.ru

QR code

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INTRODUCTION:

The study of gas-energy exchange as an indicator of the final oxidation processes, associated with metabolism and energy is of great importance in modern physiology of farm animals. The level of total metabolism in the body and the changes that occur in it, under the influence of various factors, can be judged on the intensity of gas exchange.

Each particular breed of farm animals has a complex of economic and biological characteristics that appear only under certain conditions. More plastic and promising are those breeds that are characterized by plasticity and good adaptability to certain breeding conditions with higher productivity and the lowest cost of labor and funds [1-7].

The study of individual development requires a more detailed research of metabolism and energy in animals, taking into account breed, genotype, age, feeding and maintenance conditions, as well as climatic and feeding conditions [8-22].

The study of the main indicators of gas-energy exchange is of great interest, it can be used to judge the general laws of functional transformations in the process of growth and development of the organism, the adaptation of animals to cultivation in certain environmental conditions.

The Objects and Methods of the Research:

The experimental part of the study was carried out in the foothill zone of the North Caucasus on the basis of an Agricultural Production Cooperative "Ardon" in the Republic of North Ossetia-Alania. The heifers of Swiss and Kalmyk breeds were the object of the study. During the period of all studies, the animals were kept in a room, equipped with individual feeders and automatic watering. The heifers' feeding was individual (taking into account the remains). The age, productivity, live weight and physiological condition of animals were taken into account in the process of their diets' preparation.

The intensity of gas-energy exchange was studied in three animals from each breed for 2 adjacent days, in the morning, before being fed, by the method of A. A. Skvortsova and I. I. Khrenov [9]. The comparative study of gas exchange and thermoregulation was carried out in different seasons (summer, autumn, winter and spring). Statistical processing of digital material was performed by the method of variation statistics.

The Results of the Research and Their Discussion:

It is known that the amount of absorbed oxygen and released carbon dioxide per a unit of time is one of the main indicators, characterizing the level of gas exchange in the body.

Table 1- The Seasonal Gas-energy Exchange of Heifers

Indicator	Season			
	Summer	Autumn	Winter	Spring
Swiss Breed				
The respiration rate in a minute	22,6	21,0	19,7	25,0
Pulmonary Ventilation, l/kg	0,207	0,195	0,148	0,162
The respiration depth, l	8,49	8,35	7,61	6,50
The consumption of O_2 per hour, l	111,24	108,71	104,23	122,40
The consumption of O_2 per hour, l/kg	0,349	0,309	0,275	0,280
The excretion of CO_2 per hour, l	99,28	98,43	89,06	119,84
The excretion of CO_2 per hour, l/kg	0,315	0,280	0,235	0,280
The respirational coefficient	0,88	0,90	0,87	0,97
The daily heat production, kcal	12995	12860	12272	14791
The daily heat production, kcal/g	41,12	35,29	32,38	34,56
Kalmyk Breed				
The respiration rate in a minute	20,5	22,1	20,8	24,0
Pulmonary Ventilation, l/kg	0,205	0,208	0,158	0,185
The respiration depth, l	9,37	8,43	7,69	7,71
The consumption of O_2 per hour, l	112,39	120,51	112,85	133,54
The consumption of O_2 per hour, l/kg	0,345	0,346	0,305	0,321
The excretion of CO_2 per hour, l	102,30	107,75	98,79	123,97
The excretion of CO_2 per hour, l/kg	0,314	0,308	0,267	0,298
The respirational coefficient	0,90	0,90	0,89	0,92
The daily heat production, kcal	13649	14153	13212	15787
The daily heat production, kcal/g	41,17	40,25	35,71	38,17

A comparison of pulmonary respiration of the Kalmyk and Swiss heifers (table. 1) indicate some superiority in lung ventilation of the Swiss breed heifers, in which the intensity of gas exchange and the heat production per 1 kg of live weight was the highest in summer.

The respiration rate was the lowest in winter and the highest in spring, regardless of the breed. This can be explained by the fact that in autumn the animals were before calving. This was due to the increased respiration and a decrease in its depth during summer by 1,99 ml.

The level of pulmonary ventilation in summer was 0,207 l / kg, approximately at this level it remained in autumn (0,195 l), but it sharply decreased by 39,9% in winter, and till spring it increased by 9,4 %.

The oxygen consumption and the excretion of the carbon dioxide during the year have changed with the same regularity. In absolute terms, these figures were the highest in spring, slightly lower in summer and significantly lower in autumn and winter. However, they reached the highest level in summer, being calculated per 1 kg of weight. The animals consumed 0,349 l of oxygen during summer and excreted 0,315 l of carbon dioxide, and in winter, respectively, 0,235 or 0,275 l, that is oxygen consumption has decreased by 30,5 %.

The level of the respiratory coefficient in summer, autumn and winter has not changed, but in spring it has increased and approached the unit, amounted to 0,97.

The daily heat production per 1 kg of the body weight was equal to 41,12 kcal in summer and in winter it decreased by 17,0 %.

The gas exchange of the Kalmyk breed heifers had some differences. Pulmonary ventilation in summer and autumn was almost the same, but till winter it has decreased, then in spring it increased again. It reached the highest level in autumn, and was 0,208 liters, and the lowest – in winter and was 0,158 liters.

The consumption of oxygen and carbon dioxide excretion in absolute terms increased in autumn period, but there were practically no changes per 1 kg of the mass. In winter, the consumption of oxygen decreased by 13,4 %, the excretion of carbon dioxide decreased by 15,6 %.

The respiratory rate ranged from 0,89 to 0,92. Daily heat production in absolute terms reached its highest level in autumn, but being calculated per 1 kg of live weight it was higher in summer and lower in winter (by 15,3 %).

Thus, the heifers of the Kalmyk breed had the highest gas-energy exchange in spring and summer periods. In autumn it was slightly lower and in winter it was the lowest.

When comparing the data, obtained in the result of the study of animals of different breeds, it is clear that there are no significant differences between them in summer period. In autumn, the Kalmyk animals' gas exchange was more intense than in heifers of Swiss breed. An absolute oxygen consumption was higher in Kalmyk heifers, it was10,8 and per 1 kg of live weight- it was 12,0 %. The release of carbon dioxide is higher by 9,5 and 10,0%, respectively. The heat production has increased by 10,1 and 14,0.

In winter, the intensity of gas exchange was correspondingly higher in terms of oxygen consumption, by 10.9, in terms of the excretion of carbon dioxide, by 14,0 and in terms of the heat production and by 13 %. There were no significant differences in other indicators.

Summarizing the obtained material, we can say that the heifers of Swiss and Kalmyk breeds had different reaction on changes in environmental conditions. In summer there was an increase in gas exchange and heat production in animals of both groups.

The rates of the Kalmyk heifers' gas exchange practically did not change in autumn, while the Swiss heifers' oxygen consumption decreased by12,9 %, the excretion of carbon dioxide decreased by 12,5% and the heat production decreased by 16,5%.

In both groups there was a decrease in the intensity of gas exchange in winter, but in Swiss breed it was more significant than in Kalmyk. For example, the consumption of oxygen in Swiss heifers decreased by 26,9 %, in Kalmyk heifers- by 13,4 %. Carbon dioxide excretion decreased by 34,0% and 18,3% respectively.

The subsequent increase in the level of gas exchange in spring was noted in both groups. The pulmonary ventilation increased in Kalmyk heifers by 17,1 %, and in Schwyz-by 9,4 %. The daily heat production increased by 6,9 and 6,7%, respectively. The respiratory coefficient of Kalmyk heifers remained almost at the same level, the second-slightly increased (by 11,5

%).

The spring coincided with the last period of pregnancy of experimental animals, it caused shortness of breath and made it less deep.

Our experiments have shown that Swiss animals react less intensively to changes in environmental conditions. They were more adapted to them, whereas, in such conditions the metabolic processes of Kalmyk animals were much more intense.

Table 2- The Reproductive Capacity of Heifers

Indicators	Groups	
	Swiss	Kalmyk
The total number of animals in the group, in heads	20	20
Waste as a result of abortions, heads.	1	0
Stillborn calves, heads.	0	0
Live calves, heads.	19	20
Among them: bulls	10	10
heifers	9	10
The duration of calving, min.	172,0 ± 2,40	156,0 ± 2,20
The duration of the first licking of the calf, min.	7,00 ± 0,30	7,00 ± 0,20
Duration of calf licking during the day, min.	108,00 ± 1,09	117,00 ± 1,50
Time from the moment of birth to the rise of newborn calves to their feet, min.	67,00 ± 2,50	61,00 ± 2,70
From the moment of birth to the beginning of sucking, min.	113,00 ± 9,10	104,00 ± 8,80
The output of calves per 100 heads of heifers	95	100

Table 3 - The Live Weight of Newborn Calves, kg

Indicators	Groups	
	Swiss	Kalmyk breed
The mass of newborn heifers	24,3 ± 18,2	23,2 ± 1,39
The mass of newborn calves	27,0 ± 1,45	25,1 ± 1,32

CONCLUSION:

The data on the intensity of gas-energy exchange indicate that the changes in environmental conditions, associated with the seasons have a significant impact on the body of animals, causing shifts in gas exchange. The seasonal changes in the level of gas-energy exchange are to some extent related to different breeds of animals, while the level of gas exchange was largely influenced by the productivity of animals and the nature of seasonal feeding. At the same time the animals of the Kalmyk breed were less susceptible to stressful situations associated with the change of seasons.

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