ISSN 2411-6467 DOI: 10.31618/ESU.2413-9335.2021.2.83

ЕВРАЗИЙСКИЙ СОЮЗ УЧЕНЫХ (ЕСУ)

Ежемесячный научный журнал

№ 2 (83)/2021

Том 2, Серия:
Биологические науки
Медицинские науки
Химические науки

Международные индексы:

Журнал зарегистрирован Федеральной службой по надзору в сфере связи, информационных технологий и массовых коммуникаций.

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Учредитель и издатель ООО «Логика+»

Тираж 1000 экз.
Отпечатано в типографии:
г. Москва, Лужнецкая набережная 2/4, офис №17, 119270 Россия

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СЕЛЬСКОХОЗЯЙСТВЕННЫЕ НАУКИ

УДК 636.2."464".083

INFLUENCE OF ROOM MICROCLIMATE AND CONDITIONS MAINTENANCE ON PRODUCTIVITY CALF OF THE MILK PERIOD

DOI: 10.31618/ESU.2413-9335.2021.2.83.1256

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There is a direct relationship that the microclimate of the room affects the growth and development and health of calves. Temperature and humidity are also important. Comfortable conditions for animals depend on it.

It is established that the most promising is the individual keeping of dairy calves, in contrast to the group, it completely eliminates the contact of animals, thus preventing the spread of infections between them. In addition, it creates guaranteed conditions for normalized feeding of animals according to their age and level of development and allows, if necessary, to individually adjust the level of rearing. This contributes to the creation in the production environment of a simple, clear and manageable system of growing young.

Key words: microclimate, calf, restraint, leash, stall period, temperature regime.

Abstract. The main purpose of the room where the animals are should provide them with protection from wind, cold, precipitation. Animals spend much of their lives indoors. This period is called the stall. Therefore, the microclimate indoors must meet the optimal sanitary and hygienic conditions of detention, which ensures the normal growth and development of animals. It is important to maintain the stability of the level of microclimate for calves in the stall period. This ensures the health of the animals. Accumulation of gases, moisture and microorganisms in the room can cause respiratory and digestive diseases in animals (especially young animals).

Air temperature is the main irritant of the animal's body. Depending on the level of minimum and maximum temperatures, the metabolism in the body of animals may increase or decrease. The boundaries of the zone of thermal indifference depend on the adaptation of the animal to temperature fluctuations. It can be determined by the difference between the maximum and minimum temperatures in the premises for animals during the day. The zone of thermal indifference will not adversely affect the animals, provided they adapt to changes in temperature [8].

Animals of different sex and age groups need to ensure the optimal microclimate of the room in the most difficult period of their content, proper feeding and operation, obtaining high quality products, to achieve high safety of animals [9].

Introduction. Among the factors that significantly affect the health of calves and their growth are the parameters of the microclimate in the stall period. The formation of the microclimate in livestock premises is influenced by the air environment with temperature, humidity and concentration of harmful gases [2].

Ventilation systems are equipped during the new construction of livestock facilities according to the norms of technological design [7]. In vacant buildings that previously had a suitable purpose are now not used for their intended purpose, ventilation systems are not designed to support the regulatory parameters of the microclimate. Therefore, when reconstructing existing buildings, it is advisable to take into account the systems, methods and techniques of keeping animals; livestock productivity level; level of animal feeding; fencing structures; heat balance, etc., all this requires scientific justification, compliance with the conditions of animals, especially calves [3,4].

Most scientists prefer loose group housing of calves during the milk period with the equipment of recreation areas and the use of litter [6]. This requires detailed preparation of the premises for operation by re-equipping individual cages for groups of 5-10 heads, floor heating equipment, repair of double windows, gates, doors, vestibules, ceilings and ventilation shafts with adjustable apartments to maximize heat retention in the premises [1, 5].

Relevance of microclimate research in the reconstructed Indoor is to compare the temperature, humidity and other components of the microclimate with the Departmental standards of technological design of livestock enterprises and make additions to them for calves from 1 to 8 months of age.

The aim of the study was to substantiate the formation of the microclimate in the reconstructed room for keeping calves up to 8 months of age with an assessment of the factors influencing the provision of comfortable conditions for growing calves in this period.

The process of growing young cattle covers different age periods, with the use of breeding technologies, based on the biological characteristics of the organism, they contribute to the disclosure of genetically determined productive qualities of animals.

Through many years of efforts of breeders-practitioners, dairy cattle have been adapted to obtain certain products from them in terms of industrial housing technologies, but the most dynamic in terms of adaptation processes is the sex-age group of dairy

calves, which is observed at an early age. The introduction of effective technologies involves a clear organization of a set of measures for feeding, care and maintenance of calves that meet their natural physiological needs without stressful situations.

The period in the first months of life is especially responsible, because it is during this short period that production losses occur, which are associated with morbidity and death of calves, as the most intensive development of the digestive system.

Despite the powerful arsenal of means used and a wide range of preventive measures, the losses associated with the culling of calves due to their physiological underdevelopment, structural disorders, improper behavior of animals, lesions of infections or helminthes and other differences from technological standards.

According to many researchers [2-4], it was found that the milk productivity of a newborn heifer who became ill is reduced by 18% in adulthood, and the meat productivity of bulls - by 20%. In addition, diseases of newborn calves lead to a decrease in overall nonspecific resistance and create the preconditions for the emergence of other diseases.

In the dairy period, calves are mostly tethered and untied. Leash is currently considered an outdated breeding technology or one that contradicts European requirements for livestock conditions. It does not guarantee healthy and comfortable conditions for animals, and the causes of diseases and, consequently, defective development have become more frequent. Therefore, when raising young highly productive animals is unpromising.

Small group keeping of dairy calves is effective when using technological equipment equipped with an automatic system of individual feeding with liquid feed (milk, milk weaning and substitute) by electronic sensor of animal identification. In such systems, the sucking reflex in calves is reduced due to the use of such a machine and the implementation with its help of individual feeding regimes of each calf.

Under the individual type of keeping the calf acquires a specific microflora, in interaction with which it develops normally.

Research methodology. The research was conducted in the conditions of FG "Shcherbych" Lityn district of Vinnytsia region during the winter-stable period 2020-2021. For the research, a room was chosen, where previously there was a room for quarantine of cattle for the directed cultivation of heifers. The building measures 12 × 72 m of frame construction. During the reconstruction of this room, free-range calves are kept in group cages for 5 heads. The level of feeding of calves is provided according to the accepted scheme that corresponds to feeding norms. The group cages are equipped with a feeder, watering cans and a calf rest area on a warm wooden floor with straw bedding.

Microclimate parameters were determined during the stall period: November, January and March. Air samples were taken for two consecutive days (5-6, 15-16, 25-26 days of the month), twice a day (at 10 and 20 hours), in 4 places at a height of 50 cm from the floor. In the air was determined: air temperature and humidity with a psychrometer PV-1A, bacterial air pollution was carried out using a nutrient medium for bacterial growth by conventional methods. The concentration of ammonia was determined using a gas analyzer UG-2, the concentration of carbon dioxide - 0.005N solution of liquid barium. Normative microclimate data were used with VNTP-APK-01.05 [1].

Ethological studies were conducted during the day observing calves, which were formed on the principle of groups-analogues (two groups) according to age and breed for the period November-March 2020-2021.

The research results were processed statistically according to the method of VS Patrova (2000) using PC and M. Excel program 2003. Difference between the mean values were considered probable at $P < 0.05$ [5, 6].

Research results. The air environment for calves from the first days of life can have a positive or negative effect on their health. Therefore, the comfortable keeping of calves can be judged by a set of indicators of the microclimate. The parameters of the positive effect on calves of indoor air temperature are significant. They depend on the humidity in the air, the operation of the ventilation system, the construction of the building, the number of animals and their age and more.

Today in many farms, regardless of their climatic zones, the technology of year-round keeping of dairy calves in plastic houses with a lattice aviary in the open air is introduced.

The technology of rearing allows to save significantly on the capital construction of calf premises and is considered to be the technology of the "cold method" of rearing calves. The air temperature in the calf was mostly 0 ° C, but sometimes reached -9-12 ° C. During the warm period of the year, the calves were kept in light wooden houses on straw litter outdoors.

Practical experience and scientific research of some authors [5, 9] show that low air temperature promotes the development of hair (38,4-41,9%) and skin (3,5-5,8%), the number of sebaceous glands (2,3-4,2%) in animals. This characterizes the adaptive capacity to cold conditions.

From the practical experience of farms in Vinnytsia, the "cold method" of cultivation can be divided into two periods: the first "moderately cold method" for growing in moderate temperatures in unheated rooms with a temperature of -9 ° C, developed by S. Steiman, the second - "cold method under extreme conditions of the climatic zone "growing outdoors (more than -9 ° C) and with a sharp drop in temperature, which is typical for growing calves in plastic houses-cages in the winter.

The disadvantages of this method of rearing dairy calves in winter in the Forest-Steppe zone: frostbite in calves ear and nose mirror, disease due to sharp fluctuations in air temperature, increased consumption of high-energy feed for self-heating animals, increased litter costs, reduced motor activity, irrational consumption for the additional development of protective reactions for adaptation to extreme environments, spoilage of feed, the complexity of the

work of maintenance staff for the care of calves, the additional cost of manual labor for cleaning areas.

It should be noted that the manufacturers do not specify that such equipment on the farm in the winter after the snowfall will require significant manual labor costs to clear the snow cages with calves. It is easy to guess that the process of normalized distribution of milk to calves is also associated with unfavorable working conditions in the winter – dragging with a sled or handcarts, or manual transfer of flasks of milk in the snow. Spilling milk in buckets in the cold and wind does not contribute to these technological operations, which affects animals and staff. The calf's lips and nasal mirror often freeze in the frosty wind, especially after drinking from a bucket.

It is doubtful that the service personnel (according to the instructions) at low air temperatures (below -10 °C) will cover the exit of all serviced houses with a curtain, and at -10 °C and above, on the contrary, will open. In fact, animals are left alone with adverse environmental conditions and are forced to adapt, making the most of all the resources of their body.

In winter, when keeping an animal in a cage on a deep straw litter in conditions of extreme low temperatures, it needs additional feed energy for survival and development. Instead of converting the energy of the feed into products, it is forced to spend it on self-heating of the body, on the formation of additional wool and increasing the thickness of the skin.

At the same time, the additional wool cover, which is formed in the "extremely cold" period of growing from additionally fed fodder, disappears in the warm period of the year after molting.

In addition, the calf additionally develops a system of superficial blood circulation, which participates in the transfer of heat to parts of the body. Animals with such a system of blood vessels and thick skin on hot days will additionally release heat to warm the body, feeling uncomfortable. The calf begins to transfer the energy of the feed to sweat to cool the surface of its body. If cooling during sweating does not occur, the animals may receive heat stroke. At the same time the animal refuses food, becomes lethargic and reduces productivity. To avoid this, dairy farms use fan systems to cool dairy cattle. Their installation requires additional cash costs, and the operation costs electricity.

As you can see, raising calves in the winter at low temperatures leads to disease and loss of calves at an early age.

Due to the fact that when keeping dairy calves in cages in the winter really have difficulties, some companies additionally offer to buy blankets to heat the animals in the cold season.

According to the recommendation, some scientists recommend keeping two calves in the same enclosure, but the use of this method is not effective and safe as the pathogenic microflora and hair enter the gastrointestinal tract of the animal, which leads to diseases of calves.

Reconstruction of the livestock premises was carried out with the minimum costs for the farm, the main building elements of the roof with supports and walls remained unchanged. The old feeders and the floor, as well as a layer of "unsuitable" soil 500 mm deep were removed. Inside the room was laid a warm asphalt concrete floor with a slope towards the conveyor. According to the planning projects, lattice cages are placed on the floor surface of the room. The cages are placed at a distance of 50-100 mm from each other, which prevents mutual contact of animals. In winter, the temperature does not fall below + 5 °C. After landing the calves, the cages are disassembled by one worker and disinfected with an open burner flame or chlorine solution. The places where the cages stood are cleaned and disinfected for 4-5 days.

Our research showed that the air temperature in the reconstructed room was in the range of 13,4-18,7 ° C, and the average values were 15,43 ºC in January and the highest - in March (18,15 ºC) (Table 1).

Table 1

Parameters of the microclimate in the stall period when keeping calves in group cages from 1 to 8 months of age (M±m)

Indicators	hour	n	Research time			Average
			november	january	march	
Air temperature, °C	10	24	16,8±0,086	15,6±0,297	18,1±0,098	16,8±0,112
	20	24	17,2±0,089	15,3±0,408	18,2±0,161	16,9±0,163
	X	48	17,0±0,081	15,4±0,350	18,2±0,128	16,8±0,137
Relative humidity, %	10	24	71,9±0,976	82,3±1,393	67,4±0,757	73,8±0,720
	20	24	70,5±1,395	78,3±1,087	65,6±0,673	71,4±0,770
	X	48	71,7±1,159	80,3±1,128	66,5±0,703	72,6±0,721
Carbon dioxide concentration, %	10	24	0,18±0,004	0,21±0,010	0,15±0,002	0,18±0,004
	20	24	0,16±0,006	0,20±0,007	0,14±0,004	0,16±0,004
	X	48	0,16±0,006	0,20±0,027	0,15±0,004	0,17±0,004
Ammonia concentration, mg/m^3	10	24	11,6±0,286	16,0±0,537	9,3±0,669	12,0±0,309
	20	24	9,8±0,119	14,6±0,490	7,9±0,210	10,8±0,169
	X	48	10,7±0,171	15,3±0,527	8,6±0,433	11,4±0,193
Total microbial contamination, KUO	10	24	45,3±1,311	63,2±2,442	48,2±2,514	52,3±1,819
	20	24	49,4±1,689	64,3±2,322	50,4±2,769	54,7±1,950
	X	48	47,4±1,358	63,7±2,268	49,3±2,603	53,5±1,892

The dynamics of changes in indoor air temperature during the month on set days 5, 6, 15, 16, 25, 26 indicate some advantages of air temperature at 20 o'clock compared to 10 o'clock. This is due to the fact that the external temperature at night is lower than during the day. The highest room temperature for calves was in March. These data indicate that the temperature in the room for calves depends on the month of the year (November, January, March) and time of day. But they were in the parameters acceptable VNTP-APK-01.05 [1].

In the warm period of the year, calves are kept under a canopy in an open pavilion, which is located on the leeward side of the calf building and is protected by wind from the mud.

The existing long-term experience of operation of the pavilion in climatic conditions of Vinnytsya region indicates the possibility of comfortable keeping of calves in it from April to October. All this period the calf room is cleaned and is on preventive ventilation. This seasonal mode of operation of "empty-occupied" facilities maintains the required sanitary and epidemiological level of calf rearing technology. In winter, the pavilion is used to store hay and straw litter.

In November, during the month of research at 10 and 20 o'clock, the air temperature dropped slightly. In January it was the lowest almost until the middle of the month, and then increased, but was lower than in November (Fig. 1).

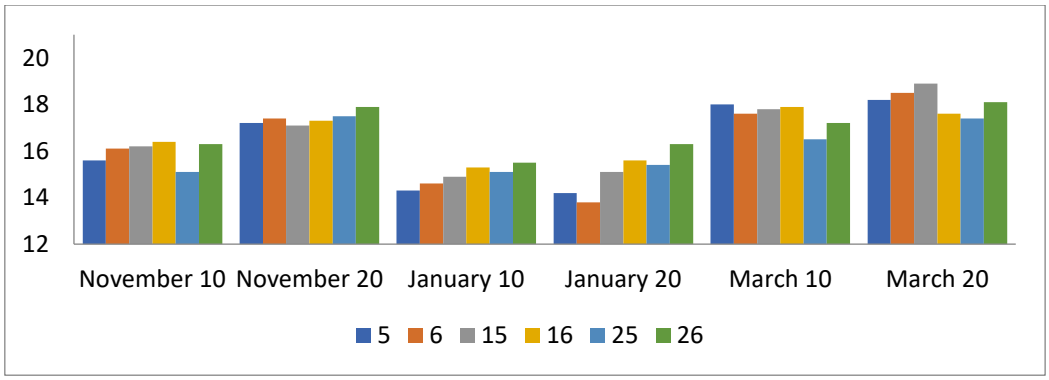

Fig.1. Dynamics of changes in air temperature in the room for keeping calves from 1 to 8 months of age

The relative humidity in the room for calves was: in November 71.14%, in January - 80.31% and in March - 66.54% (see Table 1). These data indicate that with a decrease in outdoor temperature in January, the relative humidity in the room increased significantly, and in March decreased.

The dynamics of changes in relative humidity in the room indicates that at 20 o'clock it decreases compared to 10 o'clock (Fig. 2).

The concentration of moisture in the air came closest to the normalized level in November and March. At the same time, in January it is advisable to make additions to the equipment of the ventilation system, which will reduce the level of relative humidity. It is proposed to use heat exchange equipment, which will increase the temperature of the air entering the room and reduce the accumulation of moisture condensate on the enclosing structures of the building. Such technical solutions coincide with research [1].

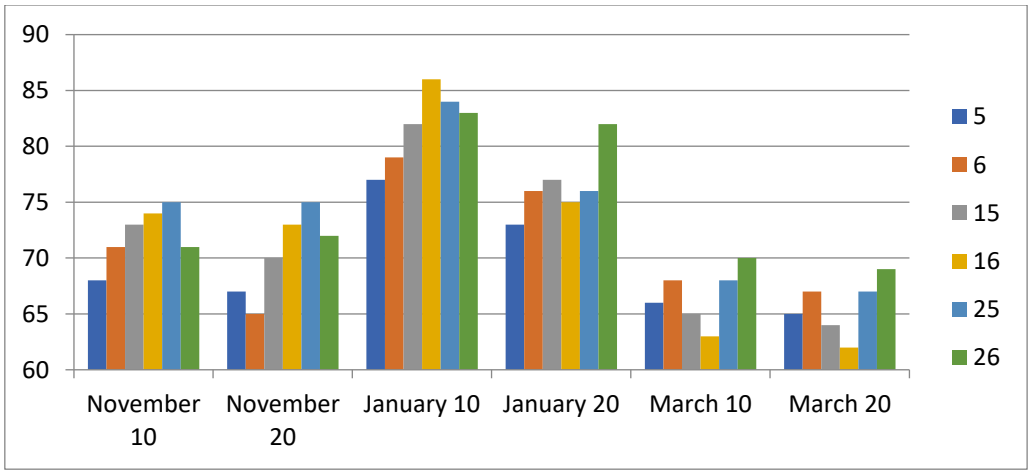

Fig. 2. Dynamics of changes in relative humidity in the room for keeping calves from 1 to 8 months of age

The concentration of carbon dioxide in the air of the calf room was the lowest in March (0,15%) and the highest - in January (0,20%), but these indicators of the concentration of carbon dioxide in the air of the premises for keeping calves are within acceptable VNTP-APK -01.05 (see Table 1).

Figure 3 shows the dynamics of changes in the concentration of carbon dioxide in the room for keeping calves from 1 to 8 months of age.

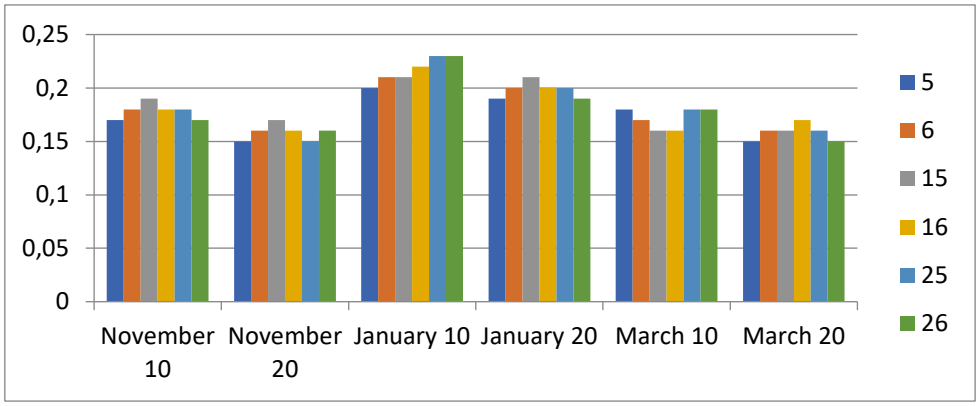

Fig. 3.Dynamics of changes in the concentration of carbon dioxide in the room for keeping calves from 1 to 8 months of age

Figure 3 shows that during the day when determining the concentration of carbon dioxide in the air at 10 o'clock it was a little more than 20 o'clock. This is due to the fact that at night the calves rested more and additional air from outside except the ventilation system did not come.

In January, the concentration of ammonia in the calf room was the highest, coinciding with the lowest air temperature and high humidity (see Table 1).

The dynamics of changes in the concentration of ammonia in the air of the calf room showed that at night more ammonia accumulated in the air than during the day (Fig. 4), regardless of the month of the stall period. The most prosperous month in terms of ammonia concentration is March.

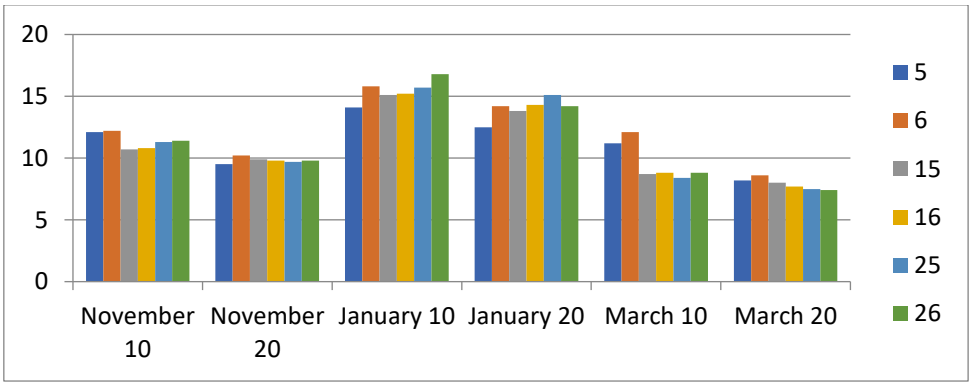

Fig.4. Dynamics of changes in the concentration of ammonia in the room for calves from 1 to 8 months of age

Regarding the total microbial contamination, it is advisable to note significant differences between its accumulation in November and March, we did not establish, and in January - the largest (see Table 1). This is due to the fact that the most favorable environment for the reproduction of microorganisms were the conditions in January (temperature and humidity) (Fig. 5).

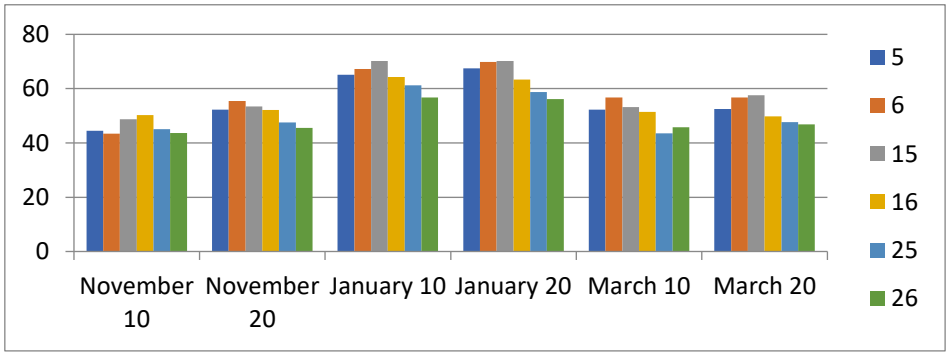

Fig. 5. Dynamics of changes in the total microbial air pollution in the room for keeping calves from 1 to 8 months of age

The dynamics of changes in the total microbial air pollution in the premises for keeping calves from 1 to 8 months of age showed a tendency to some decrease from the beginning to the end of the month (November, January and March).

Thus, the application of the above technological solutions makes it possible to prevent the impact of extreme environmental conditions, eliminate frostbite of animals and save on the purchase of individual means of warming calves.

Practical experience of raising calves by this technology allows for stable average daily gains in different seasons of the year (750-850 g) to obtain animals of the class "elite" and "elite-record".

Thus, when organizing an effective business on the basis of low-capacity commercial dairy farms, it is necessary to build a rational system of growing young animals, taking into account the biological features of animal development. The breeding system used must, first of all, reveal the productive (rather than protective) qualities of the animal due to its genotype. This feature is relevant when growing young in the cold season.

The inconsistency of the habitat of the used system of keeping with the comfortable conditions of animal husbandry creates unfavorable conditions for development. As a result, the animal body uses its own resources to develop protective rather than productive qualities. In particular, this may affect the increased feed consumption (for additional heating of the body, the formation of wool and increase the thickness of the skin), which, in turn, will increase the cost of production, as feed consumption increases.

Therefore, it is desirable to achieve a comfortable environment for rearing dairy calves with industrial technologies at minimal cost for reconstruction or new construction and arrangement of areas for groups of animals or individual cages.

As is known, in recent years, approaches to the breeding and fattening of cattle to determine the methods of keeping livestock in small livestock enterprises have changed significantly. Influence of conditions of keeping calves in the experimental farm (Table 2).

Table 2

Behavioral reactions of bulls 6 months of age from 6 to 20 hours (840 minutes), min., n = 20

A group of calves	Actions of calves, min. for the period from 6-00 to 20-00				
	eat food	chew gum	to stand	to walk	to lie
I	74,2	48,5	27,8	314,8	374,7
II	78,7	47,6	31,7	322,6	359,4
On average, min.	76,45	48,05	29,75	318,7	367,05
%	9,2	5,7	3,5	37,9	43,7

From the data of table 2 it is seen that within 840 minutes calves perform different actions that coincide in time, ie the action of some animals leads to reproduction in others, during which reflexes are produced for eating food, drinking and chewing or resting time.

Figure 6 shows the ratio of actions in percent, where 840 minutes it is 100%.

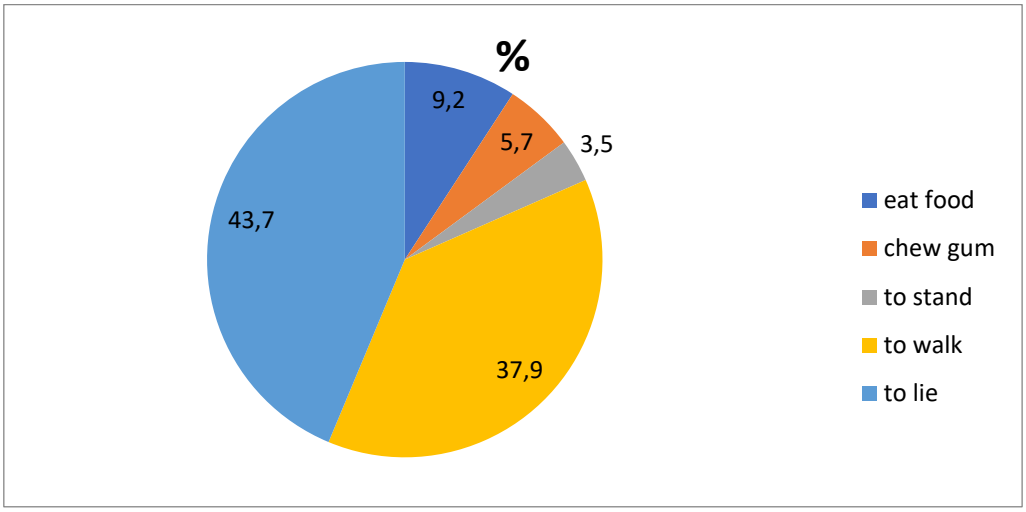

Fig. 6. The activity of calves for 840 minutes

Thus, with loose housing, calves spent the most time lying down – 43,7%, which indicates the comfort of their rest; on the go – 37,9%, which shows their activity; for eating food - 9.2%, for chewing gum – 5,7% and for standing – 3,5%, which corresponds to the physiological norm.

The formation of technological groups with free-range calves depends on the behavior of livestock and age. The relations between the animals in the group are manifested according to the instincts of herd behavior and the created conditions of their breeding and maintenance in compliance with sanitary and hygienic requirements.

It was also important to investigate the activity of behavioral reactions of calves during the experimental period of time (table 3).

Table 3

Behavioral reactions of calves up to 6 months (6-20 hours a day), n = 20

Indicator	Norm	Groups of animals		Average
		the first	second	
They drink water	4-10	8	7	7,5
They eat food	8-12	10	7	8,5
Chew gum	14-20	7	8	7,5
After the movement stands	8-15	9	11	10,5
To lie	7-20	18	18	18,0

The data in Table 3 show that most calves go to bed and get up from rest - 18 times, spend on standing and licking each other - 10.5 times.

Conclusions:

1.The parameters of the microclimate in the stall period when keeping calves depend on the humidity in the air, the operation of the ventilation system, the structure of the building, the number of animals and their age, and more.

1) Our research showed that the air temperature in the reconstructed room was in the range of 13,4-18,7 °C, and the average values were 15,43 ºC in January and the highest - in March (18,15 ºC).

2.The direct dependence on a way of the maintenance is established. Preference is given to loose group keeping of calves during the milk period with the equipment of recreation areas and the use of litter. And also creation of optimum technological conditions (microclimate)

3.Raising calves in conditions that meet the biological needs of the body, contribute to the optimal course of physiological processes, maintaining animal health and development, normal reproductive capacity and high milk productivity in the future.

4.It is established that for 840 minutes calves perform different actions that are the same for those animals in the group, ie this leads to copying actions and physiological needs for eating food, drinking water, time for chewing gum and synchronicity of rest.

5.It is proved that calves spent the most time lying down when they were kept loose - 43.7%, which indicates the comfort of their rest and satisfaction of their physiological needs.

6.Behavioral reactions of calves to the daily routine and method of their maintenance corresponded to the technological process and physiological needs, their live weight gain corresponded to the norms.

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