METABOLIC PARAMETERS IN PIGLETS REARED IN DIFFERENT CONDITIONS OF MICROCLIMATE

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Abstract

The aim of the work is to clarify the changes in the level of nonspecific natural resistance, indicators of the biochemical composition of blood, the intensity of growth of piglets grown in different microclimates. Two boxes designed for growing 300 piglets (from birth to 60 days of age) in each were identified for research. Piglets of the control group were kept on electrically heated floors, experimental – in machines with heated electric heaters with supply of fresh air to each box at the rate of 35-40 m^3/h/kg live weight. The state of the microclimate was assessed by physical parameters, chemical composition and total bacterial contamination of the air. Criteria for the evaluation of health status of piglets was morphological, biochemical and immunological indicators of blood, such as bactericidal activity of blood serum (BASB); lysozyme activity blood serum (LASB); cellular factors of protection. For tests of general resistance of piglets were taken – live weight, morbidity and survival, which were controlled by weighing and daily accounting at different ages (15, 30, 60 days). Maintaining piglets in comfortable and uncomfortable conditions of the microclimate revealed a decrease in rod neutrophils and an increase in lymphocytes, a decrease in the ratio of lymphocytes to neutrophils. In animals grown in uncomfortable conditions (experimental), a decrease in total protein by 3.64 %, albumins – by 6.44 %, and globulins – 51.05% (15-day age), 56.37 % (30-day), 63.5 % - (60-day) was established. Studies have shown that piglets from the control of the enzyme activity of blood (ALAT) superior to 60 - day-old analogues from the experience of 5.1 %, ASAT – 7.4 % ($p \leq 0.05$). The level of total glutathione in the control was 24.2 g/% (15 -day) and 18,7 % (60-day age), or respectively lower by 12.6 % and 4.5 % in the experience group ($p \leq 0.05$), which caused a decrease in the immune and antioxidant capacity of piglets caused by the high content in the air of the experimental box of harmful gases and microflora.

Key words: metabolism, microclimate, pigs, blood, resistance

INTRODUCTION

In conditions of intensive pork production, isolation of animals from the natural environment has increased [8,17]. Animals experience large functional loads (concentrate type of feed, lack of solar insolation, early weaning, numerous rearrangements), which often become stressful for them. The discrepancy of the conditions of the microclimate (temperature, humidity, high contamination of microflora and harmful gases) the physiological state of animals determines the deceleration they oxidation-reduction processes in tissues, reducing humoral and cellular defense factors, the deterioration of the biochemical composition of the blood, depression of growth and development, increased morbidity and mortality of calves. As for the microclimate and its impact on the clinical and physiological state, metabolic processes and immunobiological parameters, the safety of livestock, they require further study in terms of the complex effect on the body of pigs. In the conditions of intensive pig breeding, almost all young animals are born unviable, its functions are in a state of unstable equilibrium and experience a sharp negative impact of the environment. Despite numerous researches, [3,10,14,15] influence of abiotic and biotic factors on an organism of pigs is still insufficiently studied, and therefore and for today this problem is actual. The aim of the work is to find out the change

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in the level of natural resistance indicators of biochemical composition of blood, live weight, safety of pigs grown in different microclimates.

MATERIALS AND METHODS

Studies were performed on suckling pigs. For experience were identified as two of boxing, designed for the cultivation of 300 pigs each. Piglets of the control group from birth to 60 days of age were kept on electrically heated floors, experimental – in machines with heating of the common room due to electric heaters and fresh air supply at the rate of a sow with a litter of 30-35 m/h/c live weight. The state of the microclimate was assessed according to the "Guidelines for zoo-hygienic rationing, integrated assessment and calculation of technological regimes to ensure the microclimate of industrial buildings in industrial livestock [11]. During the experiment, the air temperature, its relative humidity, the concentration of carbon dioxide, ammonia, hydrogen sulfide were determined in the boxes according to the generally accepted methods in hygienic practice (Cherniy N. V. 1999). The criterion for assessing the state of the body was blood. In whole blood morphological parameters were determined, in serum – total protein and its fractions (S. Cornelly, 1999), activity of aspartate aminotransferase (ASAT), alanine aminotransferase (ALAT) by K.G. Capetanaki, 1962, cellular factors - by S. I. Plyashchenko, 1973; bactericidal activity of blood serum (BASB) – by O.V. Smirnova, T.A. Kuzmina, 1966, lysozyme activity of blood serum (LASB) – by V. G. Dorofuychuk, 1968. For the tests the total resistance of piglets were taken of their live weight, safety, morbidity.

RESULTS

The research was carried out in the winter. The microclimate in the boxes was controlled by physical indicators of air, chemical composition and its contamination by microflora (table 1).

Table 1 Parameters of microclimate in experimental boxes

Temperature, °C	before setting	1-5	7-15	16-20	30	**60**
	26-24 18-20	24-22 16-14	23-21 15.8-14.2	24-21 16-12	23-20 14-12	24-20 15-13
Relative humidity, %	60-70 60-72	65-75 78-80	60-78 76-80	66-78 77-82	68-72 78-80	68-74 80-82
CO_2 l/m^3	1.0-1.2 1.1-1.2	1.2-1.5 1.5-1.8	1.5-2.0 1.8-2.0	1.8-2.2 1.9-2.3	1.8-2.4 2-2.6	2.0-2.5 2.2-3.0
NH_3 mg/m^3	5-10 20-22	5-12 21-23	6-11 20-24	8-12 18-24	8-10 20-23	9-16 22-26
H_2S, mg/m^3	not >10 not >10	0.5-8 15-20	5-7 16-19	7-9 18-20	8-10 14-20	9-11 18-22
GBAP, thousand CFU/m^3	not>10 not >10	70.4±2.5 214.5±4.1	80.6±3.3 263.1±6.0	120.0±3.4 380.3±12.5	280.2±7.4 415.0±10.4	156.1±5.3 378.-0±10.2

Note: GBAP – general bacterial air pollution; in the numerator – indicators from the control box, in the denominator – experimental

In general, when the fluctuations in the microclimate in the box were at an air temperature of 22-24 °C, humidity – 65-78%, the concentration of carbon dioxide – 1.5-2 l/m^3, ammonia – 10-16 mg/m^3, hydrogen sulfide – 9-11 mg/m^3, the microflora content – 185 thousand CFU/m^3, we characterized these conditions as an acceptable design and technological mode (ADTM), and in the box with significant fluctuations, according to these parameters, as the level of limit daily fluctuations (LLDF). Under the specified conditions of the microclimate we evaluated the health status of animals on leucoformula, protein composition, humoral and cellular factors of nonspecific natural resistance of the organism [5]. An indicative criterion for assessing the immune status of the body is a blood leukogram (table 2).

Table 2 Leukocyte formula of young pigs from experimental sectors

Leukocytic formula, %				
		Age, days		
		1-12	13-30	31-60
Basophils		0.16 0.18	0.41 0.45	0.30 0.29
Eosinophils		1.22 1.25	4.97 5.03	3.94 3.91
Lymphocytes		27.82 27.02	26.80 26.82	27.98 27.7
Monocytes		3.53 3.23	5.02 5.47	2.57 2.59
Neutrophils	Myelocytes	0.33 0.32	0.26 0.02	0.37 0.35
	Young	3.14 3.02	1.02 0.66	0.99 0.95
	Wand	17.37 17.34	7.12 6.76	7.04 6.97
	Segmental	46.78 46.86	25.12 24.71	24.50 23.94
	Total neutrophils. %	27.8 27.02	26.80 26.82	53.76 62.97
	The ratio of L:N	0.41 0.40	0.47 0.43	0.52 0.42

In pigs from the control group revealed a decrease in neutrophils (56.88 % and 53.76%) and increased lymphocytes, which can be considered as a criterion for improving their immune status. With age, the number of leukocytes increases, and neutrophils – decreases, which indicates an increase in the protective functions of the body, which is consistent with messages [2,7,13]. In our studies, the ratio of lymphocytes to neutrophils in pigs from the experiment was lower at the age of 13-30 days - by 8.52 % ($p \leq 0.05$), at 31-60 days by 19.74 % ($p \leq 0.05$) compared with the control group. In the analysis of the leukoformula, they have a shift to the left, that is, an increase in the percentage of lymphocytes of immature forms to mature. This, apparently, indicates a decline in activity of cellular indicators of resistance and adaptation abilities of an organism to be comfortable microclimate [12]. Growing pigs in different microclimate conditions is characterized by such veterinarian indicators (table 3).

Table 3 Live body weight, morbidity and safety of piglets in experimental boxes

Indicators	For the day of life		
	15	30	60
Live weight, kg	1.48 1.49	6.43±0.20 5.10±0.15	16.88±0.10 14.12±0.2
The absolute gain, kg	–	4.95 3.61	10.45 9.02
% to experience		72.76	86.31
Average daily growth,g		330 240	404 300
% to experience		71.12	72.25
Number of piglets in the experience, a goal	288 290	280 275	275 267
% to experience		98.2	97.09
Sick: diarrhea % W-K disease %	2.43 2.27	1.42 5.45	0.72 2.24
Respiratory %	1.04 2.75	1.78 4.0	0.36 1.5
Safety, %	100 89.1	100 85.3	92.4 80.6
Minus - the options, %	-	-	2.5 9.4

Note: in the numerator – indicators in the control group in the denominator – in the experimental; p≤0.05 relative to the control

In pigs aged 15 days (control group), the average daily weight gain was higher by 27.3% ($p \leq 0.05$), in 60 days – by 27.7% compared to the experimental. At the age of 2 months they surpassed their analogues in live weight by 2.76 kg or 16.5% ($p \leq 0.05$). In piglets grown at standard microclimate parameters, fewer cases with signs of diarrhea were registered, compared with uncomfortable conditions: up to 15 –day-old by 5.84%, by 4.03% - up to 30 day-old and by 1.52% - 60 days. Standard hygienic conditions in the control allowed to prevent non-communicable respiratory diseases in young pigs, the number of which was less than in the experimental sector by 11.3 – 12.4 %, and their safety was higher by 11.8 %. It should be noted that in the experimental group identified more than 6.9% of the pigs minus-variants, lagging behind in live weight by 10-15 % compared to normotrophic. The influence of microclimate factors and the body's ability to adapt to these conditions [1,4] is determined by the intensity of biochemical processes [9]. The response of protein composition of blood of young contained in the different conditions of the microclimate are given in table 4.

Table 4 Total protein and protein fractions of blood serum of pigs in experimental boxes

Indicators	The study in the age			The average value
	15	30	60	
Total protein, g/l	65.77±1.10 61.06±0.09	61.02±1.05 58.48±1.8	61.20±2.3 51.84±1.7	63.69 57.12
% to experience	92.83	95.83	84.74	91.13
Albumins, g/l	31.41±0.19 29.85±1.08	29.45±0.98 28.40±0.31	32.5±0.40 30.40±0.36	31.12 29.55
% to experience	95.03	96.03	93.56	94.87
Globulins, g/l	34.36±0.31 31.21±0.40	31.57±0.28 30.0±0.32	28.5±1.8 27.44±0.01	31.47 29.55
% to experience	90.8	95.21	95.37	93.79
Gamma globulins	21.42±0.22 9.2±0.20	20.30±1.7 9.4±0.11	16.74±0.30 6.1±0.23	19.48 8.23
% to experience	42.95	43.63	36.5	41.02

Studies have shown that the animals grown in comfortable conditions (control) during the growing period exceeded the experimental content of total protein by 3.64%, albumin – by 6.44 -3.70 %, globulins, especially gamma globulins – by 51.05 % (on the 15th day of life), 56.37 % (on the 30th day) and 63.5 % (on the 60th day ($p \leq 0.01$).

No less important informative indicators in the process of protein metabolism, occurring in the body belongs to humoral and cellular factors of natural resistance [6] and aminotransferase enzymes (table 5).

Table 5 Resistance and fermentativenoi the blood of pigs from experimental groups

Indicators	The study in age, days				
	initial	15	30	60	mean
AsAt, mmol/ml	2.30±0.01 2.13±0.01	2.4±0.01 2.2±0.01	2.62±0.02 2.53±0.02	2.76±0.01 2.62 ±0.02	2.78 2.68
% to experience	92.6	92.7	96.6	94.2	96.4
AlAt,mmol,ml	2.44±0.01 2.25±0.01	2.39±0.02 2.42±0.01	2.30±0.01 2.08±0.02	2.41±0.01 2.25±0.1	2.38 2.25
% to experience	92.2	101.3	90.4	93.4	94.5
BASB, %	48.01±0.2 40.12±0.19	49.27±0.35 37.65±0.3	51.7±0.3 38.75±0.3	54.19±0.8 39.17±0.60	50.79 38.92
LASB, %	47.18±0.2 36.85±0.1	46.84±0.3 22.12±0.2	48.54±0.1 22.07±0.2	49.33±0.2 36.05±0.3	47.97 29.32
Phagocytic activity of neutrophils,%	25.6±0.24 17.88±0.2	28.3±0.12 19.37±0.1	27.04±0.2 22.15±0.2	28.19±0.3 21.4±0.1	27.28 20.2
Phagocytic index,	1.48±0.03 1.30±0.01	1.50±0.02 1.32±0.02	1.52±0.01 1.33±0.01	1.52±0.01 1.34±0.02	1.505 1.32

Note: in the numerator, the indicators of the content under optimal conditions (control), in the denominator – experience

In our studies, the activity of Alt at the end of 60 days of age was higher than in the control by 5.1%, and ASAT – by 7.11% than in the experimental.

Humoral protection factors (BASB and LASB) in pigs from the control were higher compared to the experimental: BASB – 17.87%; LASB – 11.45%, with the lowest values (32.12% and 32.7%) were established in animals 15 - and 30 days of age; cellular factors – the value of the phagocytic activity of neutrophils in the experimental group did not exceed – 17.88% and 19.37% (15-and 30 days of age) or overall lower by 6.33 %, phagocytic index – less by 12.3%. ($p \leq 0.05$).

CONCLUSION

Temperature and high humidity in combination with high gas content of air and its contamination by microflora negatively affect the growth of piglets, their resistance to environmental factors. Low air temperatures and its differences in the area of animals have inhibitory effects on the formation of cellular and humoral factors of nonspecific natural resistance. In pigs, contained in a comfortable environment (ADTM), BASB level compared with the (LLDF) is higher by 17.87%, LASB – by 11.45% ($p \leq 0.05$), with age they increase the number of lymphocytes, and neutrophils – decreases, indicating a high immune status of their body: the ratio of L:H is higher by 8.52% (30 –day) and 19.24% (60-day). Animals kept in uncomfortable conditions lag behind in live weight growth by 16.5% ($p \leq 0.05$), average daily growth by 27.3%, among them 9.4% more negative variants are registered, and safety does not exceed 80.6%.Temperature in the range of 16-12°C reduces the natural resistance of piglets, the concentration of AsAT and AlAT in the blood, and this contributes to colonization of the intestine by pathogenic microorganisms and inhibits the growth of beneficial bacteria bifidobakterii, in result, it killed the normal microflora [16]. Low temperatures, high concentration of harmful gases and air contamination by microflora, reduce the protective functions of the respiratory and digestive tract mucosa, lead to intoxication of the body and the manifestation of gastrointestinal and respiratory diseases.

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