NATURAL RESISTANCE OF PIGS TO DIFFERENT ABIOTIC FACTORS

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Abstract

The article summarizes our own research and the publications on the importance of hygiene sanitary and technological factors to ensure disease prevention, to increase the resistance and productivity of pigs. The emphasis has been done not on the treatment but on the prevention of swine diseases due to the optimization of the standards of hygienic parameters, tolerated permissible concentrations of substances in the environment, their influence not only on the processes of thermoregulation in the body and body adaptation but also to the increase in the resistance of the body to infectious agents. Due to non-observance of the rules of hygiene and sanitation, feeding and drinking regimes in the pig-breeding enterprises, the annual death of animals exceeds 25%, the diseases of the digestive tract are registered in 40-50%, respiratory diseases - in 25-30% of cases. Growth retardation is registered in the young animals, the durability does not exceed 83.2-85.6%. High indoor air humidity should be considered as a factor of importance in the etiopathogenesis of respiratory diseases and temperature changes - as a factor to prevent hyperthermia and hypoglycemia. The increase in the efficiency of the work in pig-breeding complexes can be achieved: - firstly, due to the decrease in the influence of environmental factors having the negative impact on the development of swine immunity; secondly, due to the elimination of negatively acting agents from the external environment and the strengthening of factors that increase the resistance of the body; thirdly, due to the development of nonspecific immunostimulants and their rational use in the pig - breeding practice.

Key words: swine, resistance, hygiene, sanitation, abiotic and biotic factors

INTRODUCTION

One of the main tasks of veterinary science and practice is to provide the effective protection of swine from diseases [23]. Growth intensity retardation and the manifestation of non-contagious diseases are caused by such factors as non-compliance with microclimate and sanitary intervals for each age group of pigs, their feeding and drinking regime, low level of qualification of service personnel and zootechnical and veterinary specialists. As a result, the annual death of pigs exceeds 25%, respiratory diseases are registered in 25-32% of cases, the diseases of the digestive tract are revealed in 40-50% [12, 30]. The nonspecific resistance of the body is weakened in the pig-breeding enterprises with a capacity of 12-24-36-54 thousand of heads and with 2-2.2 farrowings, with the weight gains that are not less than 400 g / day in the pigs on rearing and 500 g/day in the pigs on fattening [20, 29]. The problem of swine disease prevention, the increase in their productivity and resistance to stressful abiotic and biotic factors is one of the most urgent since it is directly connected with the quality of the products. Therefore, special attention should be paid to the issue of sanitary and hygienic provision on pig-breeding farms [10].

The aim of our work is to analyze the publications on the role of sanitary and hygienic and technological factors in the prevention of swine diseases and in the increase in swine productivity.

MATERIALS AND METHODS

The review of the publications has been done and the results of our own studies on swine resistance, productivity, conservation and incidence have been analyzed to obtain

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the necessary information to reveal the factors that influence the efficiency of the pig-breeding industry.

RESULTS

The importance of the above problem and the necessity of its solution can be explained, on one hand, by the biosphere pollution by the emissions from the complex and, on the other hand, by the prevention of swine diseases. According to the reports [5, 26] a significant amount of ammonia, hydrogen sulfide, carbon dioxide, dust, microflora is emitted into the atmosphere (Table 1). The above emissions cause respiratory diseases and growth retardation in pigs.

Table 1 Contamination of air in the area of the location of the pig - breeding complex

Indicator, kg / hour	Power, thousands of pigs			
	12	24	30	108
Ammonia	8.9	17.2	20.1	54.3
Hydrogen sulfide	6.8	12.1	14.2	25.8
Dust	9.9	12.6	24.2	43.2
Microflora, billion CFU	19.8	36.6	40.2	71.8

When slaughtering every 10% of the animals has the affected lung tissue, it means a loss of 30 to 40 g of daily live weight gain. A swine that loses 30 grams of average daily weight gain needs 0.1 kg more food and if the animal puts on 75 kg (25 to 100 kg) weight, it leads to a surplus of 7.5 kg of feed/head, it is 1.3-1.5 euro per head in European prices and as a result it leads to the shortfall in the production (Table 2).

Table 2 Shortfall in livestock production per 1000 heads because of poor microclimate

Quantity	Livestock production, t			
	pork	beef	milk	eggs, thousand
1000	10	15	400	25

The live weight gain in the young animals occurs due to muscle tissue and in the adult animals - mainly due to fat deposition. Therefore, to obtain high live weight gains at an early stage of rearing is economically and physiologically beneficial. The production of 1 kg of meat requires 30-35MJ of exchange energy and 1 kg of fat - twice more.

The scientists and practitioners pay much attention to the provision of optimal microclimate parameters, in particular, to the temperature and humidity regime [7, 8, 28].

The experience of pork production proves that "keeping pigs in cold conditions is expensive". That is, the optimal microclimate, even if it is not cheap, can provide high productivity, conservation of animals and the production of high-quality products that makes it possible not only to recoup all the costs but also to make profit.

Modern genotypes of swine are like a Mercedes, they require proper feeding, care and maintenance, in order to get the most out of them. Such conditions are: temperature and humidity regime, full and balanced feeding by amino acid composition, especially lysine, without which protein digestion in the organism of animals and humans does not take place. And if 25 to 30 years ago pigs were treated "pig-like", that time has irretrievably gone and therefore animals require careful attention [9, 16].

The reports on the advisability of keeping pigs at low temperatures, in our opinion, are of a debatable nature. In the conditions of a shortage of energy resources to ensure the required temperature and humidity regime, first of all, it is necessary to increase the resistance to heat transfer of the enclosing constructions and then, if necessary, to use a heating system.

The studies have shown that at the outdoor temperatures below -10…-15°C (with daily fluctuations from 0 to 20 °C), the biological heat of animals is insufficient to provide the optimum temperature and humidity regime in the pigsties. The coefficient of resistance to heat transfer (CRH) of the walls is below 0.86, the ceilings is below 1.34 W/m^2 °C but it is necessary to have not less than 1.5 W/m °C and 1.8 m^{2}K/W are needed. [19, 30].

This is especially true for the construction of the floor since the pigs contact the floor for 70% of the daily time. And if the coefficient of resistance to heat transfer is less than 2 W/m^2 °C it leads to hypothermia and as a result - respiratory disease [6].

An important factor that ensures a high level of sanitary conditions on the farms is the compliance with the principle "everything is empty - everything is occupied." In our experiments, the pigs of the control group were grown in the pen (without sanitary interval), the pigs in the experimental group 2 were kept in accordance with the principle "everything is empty - everything is occupied" and the pigs of the experimental group 1 were kept in accordance with the above principle when the pens were free (wet disinfection, current repair). Under these conditions, the air contamination with the microflora was: in the control group - 486.4±20.1 thousand CFU/m^3 (before setting) and 892.0±17.1 thousand CFU /m^3 after 60 days, the experimental group 1 - 390.3 ± 18.3 - 792.6 thousand CF/m^3, in the experimental-group 2 the air contamination by microflora did not exceed 115.3±0.54 – 211.6 thousand CFU/m^3, respectively. The young animals in sections O-1 and control one were grown under the influence of biological stress - microflora, especially *E. coli*, α-β-hemolytic streptococci. The results are given in Table 3.

Table 3 Productivity, morbidity and preservation of the young depending on the principle of "everything is empty - everything is occupied"

Group	Average daily weight gain, g live weight, kg/2 months.	Disease with symptoms		Preservation, %
		gastro intestinal disorders	respiratory disorders	
The control	11.64/177	25.8	18.5	83.2
Experimental-1	12.35/189	17.6	11.2	85.6
Experimental-2	16.35/225	3.4	2.3	96.1

It can be seen from Table 3 that the use of the premises without sanitary intervals (control) or partially (0-1) did not give a positive effect. The average daily gain did not exceed 177 and 189 g, the preservation was 83.2 and 85.6%, gastro intestinal disorders were registered in 25.8-17.6%, bronchopneumonia - in 18.5-11.2%, respectively.

A factor to prevent hypothermia and hypoglycemia is the provision of temperature of 30-32°C with a decrease to 20-24°C for the suckling pigs in the area of their housing and high humidity should be considered as a factor of importance in the etiopathogenesis of respiratory diseases [3]

The duration of the use of the sows of own rearing is also an important factor in the effectiveness of pig-breeding. The importation of animals from outside, especially from abroad, can hardly be considered expedient and economically justified. From our point of view, the recognition of such an approach is not unambiguous and justified. Because of the weak selection, non-compliance with hygiene and full-value feeding, a threat to high productivity appears, and therefore it is necessary to recognize that the importation from other states is forced. Forcibly transported animals of import breeding are in a stressful situation in the absence of similar conditions and technologies that were in the "homeland". The practice shows that many highly productive imported animals have to be prematurely culled [2]. The genetic potential of domestic genotypes of swine is not worse than that of the imported ones and to a large extent they exceed the imported animals. According to Akselgaard, the founder of the Danish firm "Danosha" in Ukraine the selection, proper feeding, temperature regime and lighting for every period of animal growing, strict discipline, knowledge and skills of the staff are the solution of the problem [15].

The experience of the work of the farms shows that the metabolic pathology (vitaminosis, alimentary anemia, microelementosis, hepatodystrophy, ketosis), limb diseases: arthritis are registered in 3.8% of the pigs at the beginning of fattening, in 25.8% - at the end of the fattening period. Of the 200 surveyed 6-month- aged pigs on fattening 36% of pigs of the Landrace, Large

White breed kept without bedding on the slatted floors had the posture of a sedentary dog and immobility.

The animals of meat breeds are more susceptible to diseases. Morphofunctional disorders of the extremities were recorded in 72-80% of boars, deformation of the tarsal bones of the hind limbs was revealed in 35-43% of boars, in 7-10% of boars - paralysis of the forelegs and in 1.5-3% - paralysis of the hind limbs was registered.

In some European countries due to the achievement of genetics and quality of feeds, the costs for pork production were 2.0-3.1 kg, in Denmark – 2.66 kg, in Germany – 2.92 kg, in Ukraine - 4 kg, that is, the organization of proper feeding is a problem. Every 4th pig does not reach the commodity conditions because of the improper feeding, antisanitary conditions, respiratory diseases. Mycotoxins cause great damage to the pig-breeding enterprises that are protein factories. The analysis of the data of the toxicological laboratories proved high contamination of grain and fodder with mycotoxins. Thus, deoxynivalenol (DON) was detected in 94%, T2 - in 39%, zearalenone - in 81% of the examined samples. Mycotoxins that contaminate fodder and food (meat, milk, eggs, cheese, cottage cheese) are of great danger. The influence of temperature of 20°C or higher on the above mycotoxins is ineffective and aflatoxin is destroyed at the temperature of 32°C. Because of the low molecular weight of toxicogenic fungi, animals and humans do not produce antibodies to mycotoxins, that is, the body is not protected from their effects during their lifetime [23]. The content of mycotoxins in feeds in any concentration has a negative impact on the productive parameters of pigs (Table 4).

Table 4 Effect of DON on the efficiency of - weaner rearing

Indicators	DON content in feeds, mg / kg			
	0	4	8	10
Feeds consumption, kg / day	2.05	1.76	1.47	1.28
Feeds conversion/ gains, kg / k.ed.	2.32	2.22	2.63	2.94
Average daily weight gain, g	890	800	580	450
Price of wheat, $ / t	155	143	126	59

Despite the numerous studies, the requirements of pigs of different ages to temperatures, combination of temperature and humidity in the environment, duration of light, the bacterial composition of the air, its permissible, species and quantitative characteristics and the geometric parameters of the pigsties are not well known. In the early 80's, a sensation was reported by the Irish farmer about the effectiveness of keeping pigs on fattening at the temperature of + 30°C and humidity - 100%, when the ventilation went out of work. Nothing negative happened: no cases of animal death or diseases were registered, the average daily gain remained at the same level [25]. It is worth mentioning because I have to state that judging by the reports in the literature very few people are engaged in studying the combination of microclimate parameters (temperature and humidity) and their influence on pigs. During the experiment (1965-1966) it was proved that the pigs weighing up to 60-80 kg grew better at the temperature of 21°C (the average daily gain was 200 g more than at 16°C). It was found out that when keeping pigs at the temperatures up to 15°C, the synthesis of nitrogenous compounds in the pigs on fattening decreased by 2-3 times but at low temperatures it was enhanced and the above compounds were used as the energy material [25].

The main components of the productive potential are feeding (65%), breed features (15%), veterinary and zootechnical support (10%), conditions of maintenance (10%) [11,20]. The piglet of 60 kg live weight and an average daily gain of 850 g should consume 2.5 kg of dry matter of feeds that contains 435 g of crude protein and the body synthesizes 127.5 g of protein out of the above amount to maintain the productive

potential. This protein contains only 22 g of lysine, without lysine there is no assimilation of protein in the body of animals and humans.

There is no data on the health status of the long-living boars, sows, (6-8) farrowings of different genotypes used in the industrial pig-breeding enterprises.

In the pigsties with 2 –row-location of pens and imperfect ventilation the share of aerostases was 25-30% a and with 4- row-location of pens - 35-40% of the floor space. Aerostases are characterized by high temperature (28-30°C), humidity (86-92%), the concentration of ammonia - 20-30 mg / m^3, carbon dioxide, 2.5-3.5 l /m^3 (0.25-0.35%) which is the reason for the decrease in resistance and, hence, the safety and productivity of pigs [24]. Until now, the size of the technological groups of pigs on fattening has not been substantiated. The researchers who carried out the experiments with variants of 10, -20, -40, -50, -60, -100, -150, -200 heads in the pen without giving a reason came to the trend: "The less animals in the group, the higher the live weight gain and the higher the fodder payment for the best indicators of the quality of pork [25]. The standards of water consumption have not been substantiated. The above-mentioned standards of water for drinking 6-8 l / kg of dry fodder adopted more than 100 years ago [14] have remained unchanged for the pigs of different age groups [16,17]. And only Sas [21] clarified the drinking regimes and provided the data on the norms of water consumption by pigs. Since the composition of the ration and mixed fodders has been changed a technologist must know not only how to calculate but also what norms to introduce into the project with the given rations, the methods of fodder preparation for feeding. The problem of wastes utilization and the norms of manure and urine output has not been solved. For example, an error in their calculations per 100 grams per head on the farms with a population of 5000 pigs requires additional daily capacities (manure stores) or machines for its processing by 5 tons. In our opinion, the existing standards for pigs, for water supply and manure output have the errors of up to 50% of daily excretion [25].

The parameters of some factors such as the front and the frequency of feeding, the temperature of feeds prepared for eating have not been substantiated, there is not enough research on the study of swine ethology. The maximum permissible concentration of ammonia, carbon dioxide is required to be refined and revised since the above parameters have been provided for extensive pig breeding [4,26]

DISCUSSION AND CONCLUSION

The analysis of the literature data [1,13,18,22,31] has shown that high level of morbidity in the animals, premature culling of the breeding stock, low resistance of young animals and their growth retardation in the pig-breeding enterprises are due to a complex of abiotic and biotic factors:

-non-observance of the optimal microclimate, the maintenance of pigs under conditions of adynamia and hypoxia, high contamination of the air with microflora, the use of premises without sanitary intervals; ecologically poor habitat, weak adaptation of the imported from outside pigs to the production technology, the type of feeding by commercial feeds, insolation deficiency; metabolic disorders, caused by the use of feeds affected by fungi; due to the influence of abiotic factors: conditionally pathogenic microflora, causative agents of cutaneous and parasitic diseases [13,29]. The problem of non-contagious diseases is the most important pathology in general, including infectious pathology. That is why in the conditions of the intensive use of animals, the activity of veterinary medicine specialists should be directed not to the treatment but to the solution of the problems of disease prevention. We keep in mind: firstly, the prevention of diseases of non-contagious and infectious pathology and stress, mycotoxicosis, the development of methods to stimulate natural resistance of the body; secondly, the optimization of the microclimate in accordance with the age characteristics of the animals providing their life ability and the production of ecologically

safe pork; thirdly, the quality of feeds, the ecologization of the biosphere and the minimalization of the use of drugs, especially antibiotics; fourthly, studying the influence of environmental factors on the resistance of the body and the immunological reactivity of pigs.

The solution of the tasks posed also refers to infectious pathology since abiotic stress factors can have a depressing effect on immunogenesis and lead to a decrease in the intensity of immunity. We think that the problem of disease prevention can be solved by the joint work of infectionists and hygienists [6,23,24]. At present, hygienic and ecological standards of the environmental conditions and sanitation cannot be considered acceptable without their physiological substantiation although immunological and physiological indicators have not been widely used in the hygienic research.

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