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NAS RK is pleased to announce that Bulletin of NAS RK scientific journal has been accepted for indexing in the Emerging Sources Citation Index, a new edition of Web of Science. Content in this index is under consideration by Clarivate Analytics to be accepted in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index. The quality and depth of content Web of Science offers to researchers, authors, publishers, and institutions sets it apart from other research databases. The inclusion of Bulletin of NAS RK in the Emerging Sources Citation Index demonstrates our dedication to providing the most relevant and influential multidiscipline content to our community.

Қазақстан Республикасы Ұлттық ғылым академиясы "ҚР ҰҒА Хабаршысы" ғылыми журналының Web of Science-тің жаңаланған нұсқасы Emerging Sources Citation Index-те индекстелуге қабылданғанын хабарлайды. Бұл индекстелу барысында Clarivate Analytics компаниясы журналды одан әрі the Science Citation Index Expanded, the Social Sciences Citation Index және the Arts & Humanities Citation Index-ке қабылдау мәселесін қарастыруда. Web of Science зерттеушілер, авторлар, баспашылар мен мекемелерге контент тереңдігі мен сапасын ұсынады. ҚР ҰҒА Хабаршысының Emerging Sources Citation Index-ке енуі біздің қоғамдастық үшін ең өзекті және беделді мультидисциплинарлы контентке адалдығымызды білдіреді.

НАН РК сообщает, что научный журнал «Вестник НАН РК» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Вестника НАН РК в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному мультидисциплинарному контенту для нашего сообщества.

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Адрес типографии: ИП «Аруна», г. Алматы, ул. Муратбаева, 75

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**V. G. Semenov¹, D. A. Baimukanov², V. G. Tyurin³, N. I. Kulmakova⁴,
D. A. Nikitin¹, K. Zh. Iskhan⁵, M. B. Kalmagambetov², Kh. A. Aubakirov⁶**

¹Chuvash state agricultural academy, Cheboksary, Chuvash Republic, Russian Federation,

²Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan,

³All-Russian SRI of veterinary sanitation, hygiene and ecology, Moscow, Russia,

⁴The Russian state agricultural university – MACA named after K. A. Timiryazev, Moscow, Russia,

⁵Kazakh National Agrarian University, Almaty, Kazakhstan,

⁶Taraz State University named after M.Kh. Dulati, Taraz, Kazakhstan

ACTIVATION OF NONSPECIFIC PROTECTION OF THE ORGANISM WITH NEW IMMUNOTROPIC PREPARATIONS IN THE IMPLEMENTATION OF THE POTENTIAL PRODUCTIVITY OF PIGS

Abstract. In the conditions of a pig-breeding complex, the assessment of the efficiency of the application the PigStim-C and PigStim-M immunotropic preparations in newborn pigs for the purpose of realization of bioresource potential of productivity was carried out. It is established that the PigStim-C and PigStim-M immunotropic drugs do not exert a negative impact on the clinical and physiological state of an organism of pigs, ensure health and safety of the pigs. Against the background of immunocorrection of the organisms of pigs, 1.5-2.9 times of reduction in terms of recovery for 11.4-23.5%, increase in safety of a livestock to 98,0-100,0% are noted a decrease in the quantity of diseases. The use of immunotropic drugs in the early period of postnatal ontogenesis of pigs activates cellular and humoral factors of nonspecific protection of the organism in industrial technology: phagocytic activity of neutrophils - on 3.8-5.8% and 4.2-6.4%, bactericidal activity of blood serum - on 3.6-8.6% and 3.4-9.8%, lysozyme activity of blood plasma - on 4.8-8.6% and 4.0-8.0%. Immunocorrection of the organisms of young pigs in the early period of postnatal ontogenesis with the PigStim-C and PigStim-M immunotropic drugs promotes the realization of the bioresource potential of meat productivity. It was found that the animals of the 1st and 2nd experimental groups predominated their peers in the control in live weight by 7.1 kg or 6.9% and by 8.6 kg or 8.2%, in the average daily gain by 34 and 41 g. Slaughter weight of pigs against the background of immunocorrection was above the control by 6.22 and 7.08 kg. According to the results of the boning and trimming of half pig carcasses of the experimental groups, the increase in the number of trimmed pork by 1.88 and 2.16 kg in the 1st and 2nd experimental groups was found in comparison with the control.

Keywords: Pigs, PigStim-C and PigStim-M immunotropic preparations, immunity, morbidity and safety, productivity.

Introduction. An essential prerequisite for increasing the profitability and competitiveness of the pig husbandry is the development and improvement of the organizational and economic mechanism for the effective functioning of pig-breeding organizations. The key element of this process is the innovative renewal of the capital, which is possible through technical, organizational, economic and managerial innovations in organizations [4, 11, 12, 23-25, 32, 33, 35].

The transition of pig breeding to an industrial base, together with undoubted advantages, contributing to an increase in the profitability of the industry as a whole, provoked the aggravation and the emergence of a number of new problems, the main one being the inadequacy of environmental conditions to the biological needs of the pig's organism. The development and introduction of effective technologies for keeping, feeding and servicing animals in the production process, even if it allows to increase the productivity, improve the quality of the products received and profitability of the industry as a whole, it

often violates the phylogenetic relationships of pigs with the environment and traditional conditions of keeping and feeding. Technological methods of modern large pig breeding complexes, lack of exercise, irrational use of antibacterial drugs cause a metabolic disorder, a decrease in organism resistance of pigs, which ultimately leads to high incidence and low pig livestock [2, 8-10, 13, 15, 18, 20, 22].

In such conditions, the nature of the animal and the physiological characteristics of the organism are not able to change as quickly as the conditions of keeping, feeding and the technology of animal husbandry in general. Often the animal organism cannot avoid the action of stress factors and adapt to changing environmental conditions, which leads to various functional disorders and diseases [1, 5-7, 21, 26, 27, 30, 34].

Seeing that it is not possible to eliminate the effect of many stress factors, priority is the prevention of the negative impact of stressors on the organism, on the other hand, and the increase in adaptive abilities of animals to industrial conditions. Special attention should be paid to newborn pigs, since they are most susceptible to environmental factors, and adaptive mechanisms of their body have not been formed yet. On the other hand, the early period of postnatal ontogenesis is optimal for the directed effect on the process of formation of the protective-adaptive mechanisms of their organism. In the light of the foregoing, the use of immunotropic preparations for newborn piglets is a promising technique for intensifying the pig husbandry [3, 13, 16, 17, 19, 28, 29, 31].

The research was carried out within the framework of international cooperation of scientists from the Russian Federation (headed by Doctor of Biological Sciences, professor Vladimir Grigoriyevich Semenov) and from the Republic of Kazakhstan (headed by the corresponding member of the National Academy of Sciences of the Republic of Kazakhstan, Doctor of Agricultural Sciences Dastanbek Asylbekovich Baimukanov) on priority branches of productive animal husbandry in the period 2015-2017.

The aim of the work – realization of the bioresource potential of the pig organism by activation of nonspecific resistance by new immunotropic preparations: PigStim-C and PigStim-M.

Materials and methods. The scientific research work was carried out in the conditions of the pig breeding complex of the close company "Progress" of the Cheboksary district of the Chuvash Republic. Materials processing was carried out in the laboratory of bio- and nanotechnologies and in the laboratory of the Department of Morphology, Obstetrics and Therapy of the Federal State Budget Educational Institution of Higher Education "Chuvash State Agricultural Academy" in 2014-2017. The work was carried out in accordance with the research plan of the FSBEI HE of the Chuvash State Agricultural Academy.

The objects of research were the prenursery pigs, weaners and youngsters on fattening to slaughter for meat. Three groups of newborn piglets (control, 1st experimental and 2nd experimental) were selected according to the principle of pair- analogues, taking into account the clinical and physiological state and the live weight of 50 animals in each group.

To determine the nature of the effect on the clinical and physiological state, the hematological and biochemical blood profiles, the indices of the nonspecific resistance of the pigs organisms, as well as the growth, morbidity, safety and productive qualities of the store pigs, the newborn piglets of the experimental groups were injected intramuscularly with the immunotropic drugs PigStim-C and PigStim-M in a dose of 0.3 ml per head, three times on the 1-, 4- and 7-day of life. Animals of the control groups did not receive drugs.

PigStim-C – is complex immunotropic preparation for the realization of the biological potential of agricultural animals. The preparation is an aqueous suspension containing 2.5% of the polysaccharide complex of yeast cells immobilized in an agar gel with the addition of 1.5% benzimidazole derivative and 5% antibacterial agent of the cephalosporin group.

PigStim-M – is a complex preparation for stimulation of nonspecific resistance of the organism, prevention of diseases of youngsters of agricultural animals, is an aqueous suspension containing 2.5% of the polysaccharide complex of yeast cells immobilized in agar gel with the addition of 1.5% benzimidazole derivative and 5% antibacterial agent of the macrolide group.

Pig breeding complex "Progress" CJSC is an enterprise with a complete cycle of pork production. The technological process is organized by a three-phase in-line system for growing and fattening pigs, divided into 4 sections (stage): reproduction, farrowing, rearing and fattening. Groups of milking sows are formed in a rhythmicity of 7 days. Retirement is performed at the age of 25-26 days.

Results. The microclimate parameters in the workshops for keeping milking sows with piglets, weaners and store pigs for fattening during the whole observation period were within the limits of zoohygienic norms and corresponded to the needs of the organism, taking into account age and sex groups (table 2).

Table 1 – Microclimate of premises for pigs keeping

Index	Premises for keeping during		
	suckling	weaning	fattening
Temperature, °C	19.12±0.12 28.48±0.10*	18.80±0.17	16.00±0.15
Relative humidity, %	66.80±0.80	65.20±0.49	61.80±1.16
Air velocity, m/s			
winter season	0.10±0.01	0.14±0.01	0.23±0.01
summer season	0.31±0.01	0.44±0.01	0.68±0.03
Concentration:			
carbon dioxide, %	0.16±0.01	0.16±0.00	0.19±0.00
ammonia NH ₃ , mg/m ³	6.40±0.51	13.40±0.75	15.20±0.58
hydrogen sulphide, mg/m ³	3.00±0.32	3.40±0.51	4.20±0.58
Bacterial content, thousand tons/m ³	18.80±0.58	19.60±0.75	26.60±1.03
*Air temperature in the place of rest of pigs (lair) in the first week of life with local heating by infrared lamps.			

Feeding of pigs at the enterprise is carried out by all-in-one feeds on the basis of a grain mixture of own production with the addition of fodder concentrates produced by Premikorm OOO. Prenursery pigs begin to accustom to the independent eating of fodder, starting from the 9th day of life. In the feeding of the prenursery pigs, the SPK-3 START pre-starter feed for piglets aged 9-45 days is used. Preparation of mixed fodders for piglets weighing 12-30 kg is carried out by adding to the grain mixture of 20% KBVM SK-4 fodder concentrate for piglets. Young pigs with the live weight of 30 to 70 kg are fed with balanced feed, adding 15% KBVM SK-5 fodder concentrate, and pigs with the live weight of 70-110 kg - 10% KBVM SK-6 fodder concentrate.

The conditions of keeping and feeding pigs at the pig breeding complex of Progress CLSC in the Cheboksary district correspond to the recommended ones and promote the development of a genetically built-in productivity potential in animals, and compliance with veterinary and sanitary rules and the operating regime of the enterprise ensures its veterinary well-being.

During the experimental period, the piglets of all groups were monitored with fixation of body temperature, heart rate and respiratory movements.

During the whole period of observation, there were no obvious differences in the behavioral responses of animals, except for a short-term stress reaction in the piglets of the experimental groups after intramuscular injection of immunotropic drugs, as well as sporadic cases of diseases in the experimental groups described below.

The results of the hematological test of piglets of experimental groups are presented in table 2.

The dynamics of the number of erythrocytes and leukocytes, as well as the hemoglobin concentration in the blood of the piglets of the control, 1st and 2nd experimental groups for the entire period of observations, corresponded to the patterns of age-related changes in the blood picture and was within physiological norms.

At 14-day-old age, the number of erythrocytes in the blood of pigs of the 1st experimental group was significantly higher by 5.3%, and the 2nd experimental group by 5.8% more than in the control group. At the 30-, 60- and 90-day-old age, the number of erythrocytes also turned out to be higher than the control value in the blood of the animals of the 1st experimental group by 7.5, 7.6 and 5.1%, and the 2nd experimental group - by 8.8, 8.0 and 5.7%, respectively (P<0.05).

The concentration of hemoglobin in the blood of the piglets of the 1st experimental group at 14, 30 and 60-day-old age was higher in comparison with the control by 3.1, 4.4 and 4.7%, respectively, and in the blood of the animals of the 2nd experimental group – by 2.9, 4.1 and 4.9%. At 90-day-old age, the concentration of hemoglobin in the blood of the pigs of the 1st and 2nd groups also turned out to be 5.3 and 4.8%, respectively, but statistically unreliable.

Table 2 – Hematological indicators of young pigs

Index	Age, days				
	1	14	30	60	90
Control group					
Erythrocytes, $\times 10^{12}/l$	4.52 \pm 0.07	4.52 \pm 0.06	4.56 \pm 0.08	6.02 \pm 0.10	6.68 \pm 0.11
Hemoglobin, g/l	98.80 \pm 1.16	96.80 \pm 0.80	91.80 \pm 0.97	93.00 \pm 1.30	95.20 \pm 2.08
Leukocytes, $\times 10^9/l$	7.04 \pm 0.19	13.22 \pm 0.21	12.64 \pm 0.26	12.10 \pm 0.62	11.92 \pm 0.72
1st experimental group					
Erythrocytes, $\times 10^{12}/l$	4.50 \pm 0.07	4.76 \pm 0.05*	4.90 \pm 0.07*	6.48 \pm 0.13*	7.02 \pm 0.08*
Hemoglobin, g/l	99.00 \pm 0.95	99.80 \pm 0.86*	95.80 \pm 1.43*	97.40 \pm 1.21*	100.20 \pm 1.07
Leukocytes, $\times 10^9/l$	7.06 \pm 0.20	14.78 \pm 0.13***	15.84 \pm 0.11***	14.24 \pm 0.29*	13.86 \pm 0.32*
2nd experimental group					
Erythrocytes, $\times 10^{12}/l$	4.52 \pm 0.07	4.78 \pm 0.06*	4.96 \pm 0.09*	6.50 \pm 0.12*	7.06 \pm 0.09*
Hemoglobin, g/l	98.80 \pm 1.07	99.60 \pm 0.81*	95.60 \pm 1.29*	97.60 \pm 1.08*	99.80 \pm 1.16
Leukocytes, $\times 10^9/l$	7.04 \pm 0.18	14.80 \pm 0.10***	15.90 \pm 0.07***	14.32 \pm 0.24*	13.72 \pm 0.24*
* P<0.05; *** P<0.001.					

An increase in the number of erythrocytes and hemoglobin concentrations in the blood of the piglets of the experimental groups testifies to the activation of hemopoiesis against the background of intramuscular injection of the PigStim-C and PigStim-M immunotropic preparations in the early period of postnatal ontogenesis.

The number of leukocytes in the blood of pigs of the 1st experimental group at the age of 14, 30, 60 and 90 days turned out to be higher than the control indicators by 11.8%, 25.3, 17.7 and 16.3%, and the 2nd experimental group - 12.0%, 25.8, 18.3 and 15.1% higher, respectively. It should be noted that the number of leukocytes in the experimental groups did not exceed the limits of physiological norms. Consequently, leukocytosis occurs, not exceeding physiological norms.

The differentiation of blood leukocytes of piglets is presented in table 3.

Basophils on the first day of life were absent in the blood of the pigs of all studied groups. In the blood of the first group of pigs at the 14-, 30-, 60- and 90-day-old age, the basophils were on 0.4%, 0.8, 0.8 and 0.8% more, and the 2nd experimental - on 0.6%, 0.8, 1.0 and 0.8% more respectively, rather than in the control.

The number of eosinophils in the blood of the piglets of the experimental groups was significantly lower than in the control, beginning at the age of 14 days. This fact is more pronounced in piglets of the second experimental group.

There were no significant differences in the proportion of young neutrophils in the experimental groups ($P>0.05$).

The relative number of stab and segmented neutrophils and monocytes was lower in the blood of the piglets of the experimental groups, beginning at the age of 14 days ($P < 0.05-0.001$) than in the control. Moreover, the most pronounced difference was observed in segmented neutrophils. So at the 14-, 30-, 60- and 90-day-old age in the blood of the pigs of the 1st experimental group, the relative number of segmented neutrophils turned out to be below the control indicator by 7.0%, 11.4, 10.2 and 6.4% and the 2nd experimental - by 5.8%, 10.6, 9.6 and 5.8%, respectively. It should also be noted that in the 1st and 2nd experimental groups, despite the apparent decrease in the share of segmented neutrophils from the total number of leukocytes, their number relative to all neutrophils increased in relation to the control group. Thus, there is a decrease in the number of neutrophils with a nuclear shift to the right.

Analysis of the relative number of lymphocytes indicates a significant ($P<0.001$) increase in their number in the first and second experimental groups, beginning at the age of 14 days. This index remained higher than the control group in the animals of the 1st group at 14, 30, 60 and 90-day-old age, respectively, by 11.4%, 13.0, 12.0 and 7.8%, and in animals of the 2nd test group - by 9.8%, 12.4, 10.4 and 7.2%, respectively. Therefore, the immunotropic preparations under test cause lymphocytosis in the blood of pigs.

Table 3 – Leukocyte formula of piglets

Group	age, days				
	1	14	30	60	90
Basophils, %					
Control	–	0.2±0.20	0.2±0.20	0.4±0.24	0.4±0.24
1 st experimental	–	0.6±0.24	1.0±0.32	1.2±0.20*	1.2±0.20*
2 nd experimental	–	0.8±0.20	1.0±0.32	1.4±0.24*	1.2±0.20*
Eosinophils, %					
Control	0.2±0.20	1.0±0.32	1.4±0.24	1.6±0.24	2.0±0.32
1 st experimental	0.2±0.20	0.2±0.20*	1.4±0.24	1.0±0.32*	0.8±0.37**
2 nd experimental	0.2±0.20	0.4±0.24*	1.2±0.20*	1.2±0.20*	1.2±0.37*
Young Neutrophils, %					
Control	0.6±0.24	0.8±0.20	0.6±0.40	0.8±0.37	0.8±0.20
1 st experimental	0.4±0.24	0.8±0.20	0.4±0.24*	0.8±0.37	1.0±0.32
2 nd experimental	0.6±0.24	1.0±0.32	0.6±0.24	1.0±0.32	0.8±0.37
Stub Neutrophils, %					
Control	10.8±0.37	6.8±0.37	3.0±0.45	3.0±0.45	3.0±0.45
1 st experimental	10.6±0.40	3.6±0.40***	1.4±0.24**	1.6±0.24**	2.4±0.24*
2 nd experimental	11.0±0.45	3.8±0.37***	1.6±0.24**	1.8±0.20**	2.2±0.20*
Segmented Neutrophils, %					
Control	37.6±0.40	34.2±0.58	33.8±0.58	37.8±0.37	42.2±0.37
1 st experimental	38.4±0.51	27.2±0.58***	22.4±0.51***	27.6±0.51***	35.8±0.37***
2 nd experimental	37.2±0.37	28.4±0.40***	23.2±0.37***	28.2±0.37***	36.4±0.40***
Lymphocytes, %					
Control	47.0±0.71	53.4±0.51	58.0±0.55	53.0±0.71	47.8±0.37
1 st experimental	46.6±0.51	64.8±0.37***	71.0±0.45***	65.0±0.55***	55.6±0.51***
2 nd experimental	47.2±0.66	63.2±0.37***	70.4±0.51***	63.4±0.51***	55.0±0.45***
Monocytes, %					
Control	3.8±0.37	3.6±0.24	3.0±0.32	3.2±0.37	3.8±0.37
1 st experimental	4.0±0.32	2.8±0.37*	2.4±0.24*	2.8±0.37*	3.2±0.37*
2 nd experimental	3.8±0.37	2.4±0.24***	2.0±0.32*	3.0±0.32*	3.2±0.20*

* P<0.05; ** P<0.01, *** P<0.001.

The results of studies of the nonspecific resistance of the piglets of the experimental groups against the background of the intramuscular injection of the PigStim-C and PigStim-M immunotropic drugs are shown in figures 1-3.

At the age of 14 days, the phagocytic activity of blood neutrophils in piglets of the 1st and 2nd experimental groups was higher than the control index by 4.8 and 5.6%, respectively, at the 30-day age by 5.0 and 5.4% in the 60-day age - by 3.8 and 4.2% and at 90-day age - by 5.8 and 6.4%, respectively.

Bactericidal activity of blood serum of pigs of experimental groups did not have significant differences at 1-day-old age. However, already at the age of 14 days, it was significantly higher than the control index by 3.6 and 3.4% in piglets of the first and second experimental groups, respectively. At the 30-, 60- and 90-day-old age, the bactericidal activity of the blood serum of the first group was above the control value by 6.2, 8.4 and 8.6%, and in piglets of the second test group - by 6.6, 7.8 and 9.2% respectively.

Lysozyme activity of the blood plasma of the piglets from experimental groups had significant differences between the 14-day-old age and the end of the observation period.

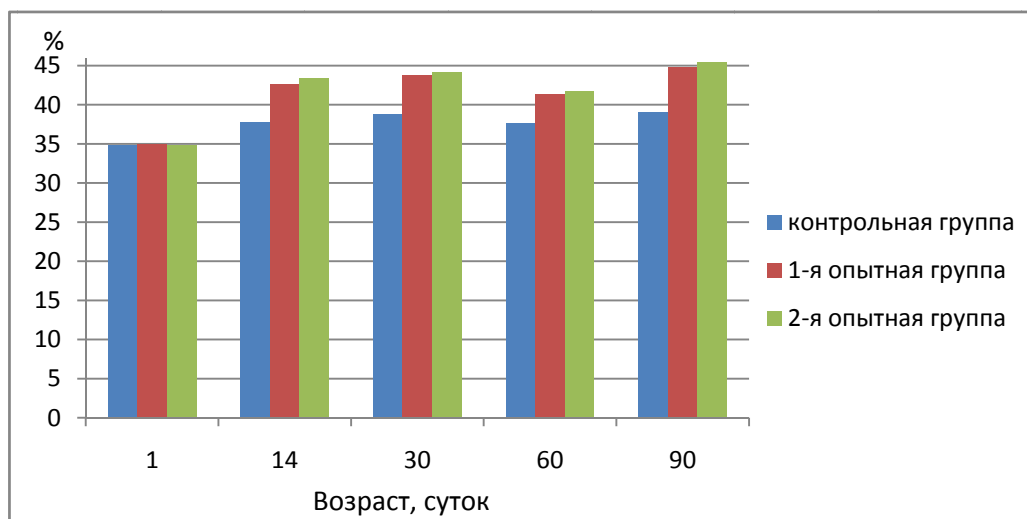


Figure 1 – Phagocytic activity of blood neutrophils in piglets

Thus, at the age of 14 days, the lysozyme activity of the blood plasma of the piglets of the control group was lower than in the first and second experimental groups by 4.8 and 4.0%, respectively, at the 30-day-old age - 6.2 and 5.4%, at 60-day-old age - 7.4 and 7.2%, at the 90-day-old age - by 8.6 and 8.0%. Thus, the results of an immunological study of blood indicate that intramuscular injection of the PigStim-C and PigStim-M immunotropic preparations in pigs in the early period of postnatal ontogenesis promotes activation of cellular and humoral factors of nonspecific resistance of the organism. It should be noted that PigStim-C has a more pronounced stimulating effect on the phagocytic activity of neutrophils and bactericidal activity of serum, and PigStim-M - on lysozyme activity of blood plasma.

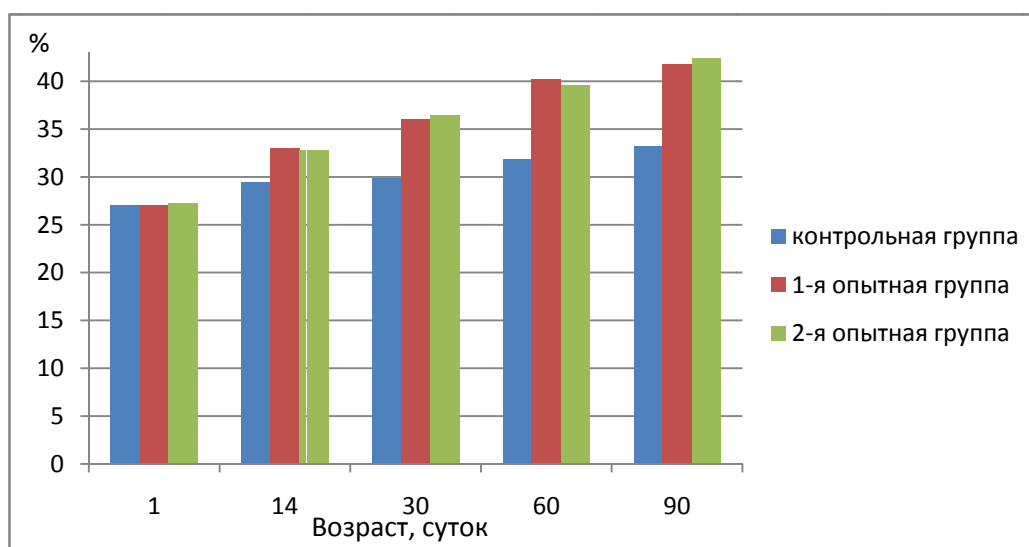


Figure 2 – Bactericidal activity of blood serum of piglets

During the experimental period, cases of diseases occurred in different periods of sowing, weaning and fattening among animals of all groups.

In the periods of newborn and suckling, diseases characterized by diarrhea of non-infectious etiology were predominantly recorded (table 4).

Diseases occurred without an increase in body temperature, pronounced anorexia and hypodynamia. Therapy for emerging diseases was carried out using adopted in the farm complex methods using antibacterial drugs of broad-spectrum.

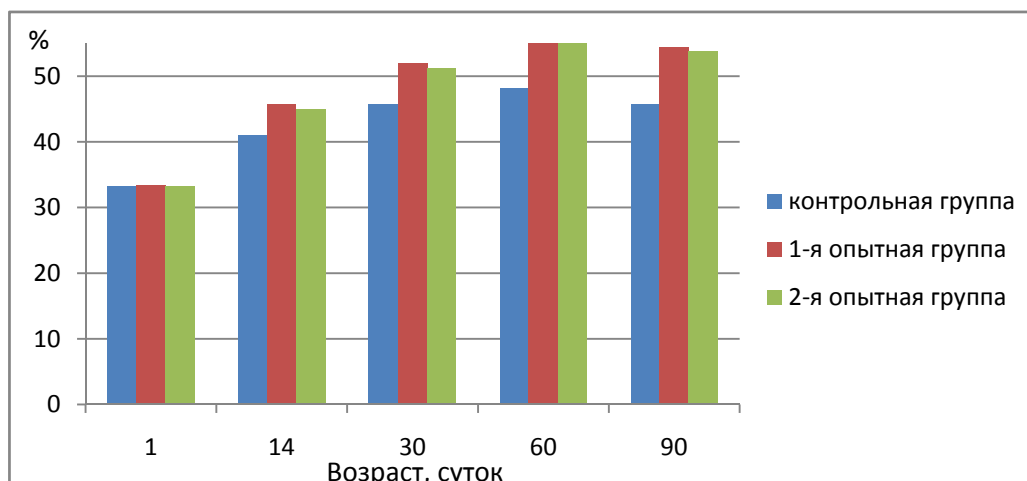


Figure 3 – Lysozyme activity of blood plasma of piglets

As can be seen from table 4, among the piglets of the control group, 26 cases of diseases were recorded during the period of the newbornness and suckling, while therapy at the occurred diseases was successful only in 24 cases, 2 pigs fell from exhaustion and dehydration as a result of diarrhea of non-contagious etiology. In the 1st experimental group, 11 diseases of piglets were recorded, 10 of them were cured and 1 died, and in the 2nd test group - 9 cases of diseases of piglets, all of them were cured. The average duration of diseases of the piglets of the control group was 1.96 days, in the first group - 1.55 days, and in the 2nd group - 1.67 days. The incidence of piglets of the 1st and 2nd test groups was lower by 30 and 34%, respectively, besides, the index of the effectiveness of therapeutic measures and the safety of piglets were significantly improved.

Table 4 – Morbidity and safety of piglets during newbornness and suckling

Index	Group of animals		
	control	1 st experimental	2 nd experimental
Number of piglets	50	50	50
Sicken	26	11	9
Recovered	24	10	9
Fell	2	1	–
Duration of diseases, days	1.96	1.55	1.67
Safety, %	96.00	98.00	100.00

Among the diseases of weaners (table 5), the leading role was occupied by edematous disease, accompanied by symptoms of reddening and edema of the eyelids, conjunctivitis, watery outflow from the eyes, and worsening of the overall clinical condition, manifested by the shakiness of gait, refusal of feed and water. Therapy in the emergence of diseases was performed immediately at the first clinical signs, before the appearance of symptoms of the nervous system, generally accepted in the veterinary treatment regimens. As well as in the suckling period, among the weaners, there were cases of diseases with symptoms of diarrhea of non-contagious etiology. In addition, in the weaning period, in the piglets, there were recorded single cases of other diseases, for example, arthritis.

Among the weaners of the control group, 14 cases of non-infectious etiology were registered, therapy in 13 of them was successful with a total duration of disease of 2.43 days, one weaner fell. In the first experimental group, 7 cases of diseases were recorded, all of them were successful, and the average duration was 1.86 days. In the 2nd experimental group, 5 diseases of piglets were recorded, all of which were cured on average after 2.00 days. Thus, the use of immunotropic drugs contributed to the decrease in the number of diseases of pigs during the weaning period by 2.0-2.8 times, and their duration by 0.43-0.67 days.

Table 5 – Morbidity and safety of weaners

Index	Group of animals		
	control	1 st experimental	2 nd experimental
Number of piglets	48	49	50
Sicken	14	7	5
Recovered	13	7	5
Fell	1	–	–
Duration of diseases, days	2.43	1.86	2.00
Safety, %	97.92 94.00*	100.00 98.00*	100.00 100.00*
* Safety for all previous periods.			

Among the diseases of young pigs of all three groups during the fattening period, the most frequent were bronchitis, which manifested itself as a cough without raising the body temperature and worsening the overall clinical state (table 6). Also, the diseases with signs of joint damage were common. Therapy in the emerged diseases was carried out by conventional methods in veterinary medicine and methods of treatment accepted in this farm.

Table 6 – Incidence and safety of pigs on fattening

Index	Group of animals		
	control	1 st experimental	2 nd experimental
Number of piglets	47	49	50
Sicken	12	7	8
Recovered	12	7	8
Fell	–	–	–
Duration of diseases, days	3.25	2.86	2.88
Safety, %	100.00 94.00*	100.00 98.00*	100.00 100.00*
* Safety for all previous periods.			

During the fattening period, among the pigs of the control group, there were 12 cases of diseases, in the first experimental group - 7, and in the 2nd experimental group - 8. The average duration of the diseases of the young animals was 3.25 days in the control group, 2.86 days in the 1st experimental and 2.88 days - in the 2nd experimental group. In this case, therapy for all cases of disease was effective and mortality was not registered.

Thus, based on the analysis of the incidence and safety of pigs during the periods of newbornness, suckling, weaning and fattening, it is established that intramuscular administration of PigStim-C and PigStim-M immunotropic drugs to piglets in the early period of postnatal ontogenesis reduces the number of diseases, shortens healing time and increases the effectiveness of therapeutic measures, and also increases safety.

During the test period, at the age of 30, 60, 90, 120, 150, 180 and 210 days, the pigs of all three groups were weighed. Individual assessment of the live weight of individuals was not carried out, each group of pigs was subjected to weighing with the subsequent determination of the average weight by mathematical means (table 7).

As can be seen from the presented table, the live weight of pigs of all three groups, having the same values at birth, systematically increased until the end of the experimental period. Thus, the live weight of the pigs of the control group at the age of 210 days was equal to an average of 103.79 kg in the group. The live weight of the pigs of the 1st experimental group at the end of the fattening period was found to be on the average 110.92 kg in the group, which is 7.13 kg or 6.87% more than the control index. The live weight of the pigs of the 2nd group also turned out to be 8.55 kg or 8.24% higher than the control value, and the average for the group was 112.34 kg.

Table 7 – Dynamics of pig growth

Age	Group of animals		
	control	1 st experimental	2 nd experimental
Live weight, kg			
1	1.00	1.00	1.00
30	6.59	7.02	7.09
60	15.23	16.23	16.46
90	26.84	28.65	29.02
120	41.81	44.61	45.22
150	59.32	63.42	64.20
180	79.94	85.50	86.58
210	103.79	110.92	112.34
The average daily gain of live weight, g			
1-30	186	201	203
30-60	288	307	312
60-90	387	414	419
90-120	499	532	540
120-150	584	627	633
150-180	687	736	745
180-210	795	847	859
1-210	489	523	530

The average daily live weight gain of pigs of the 1st and 2nd experimental groups was higher than the control indices. Thus, the indicated index of pigs of the 1st group for the 1st, 2nd, 3rd, 4th, 5th, 6th and 7th months of growth was higher than the control one by 15 g, 19, 27, 33, 43, 49 and 52 g, and in the pigs of the 2nd group, at the same time, by 17 g, 24, 32, 41, 49, 58 and 64 g, respectively. The average daily growth in the pigs of the 1st and 2nd experimental groups on average for all periods of sowing, weaning and fattening were above the control index on 34 and 41 g.

Consequently, the use of PigStim-C and PigStim-M immunotropic preparations in the early postnatal ontogenesis for pigs contributes to their more intensive growth during periods of sowing, weaning and fattening.

At the age of 210 days the control slaughter of five pigs from each group was carried out. Slaughter of animals was made in the slaughterhouse of the meat processing enterprise Shaleeva O.V. SP., 4a, Sovkhoznaya, str., Ishlei village, Cheboksary district, Chuvash Republic, according to the rules of veterinary inspection of slaughter animals and veterinary and sanitary examination of meat and meat products.

According to the results of control pigs slaughter (table 8), it was revealed that the slaughter yield in the pigs of the control group was 67.83%, with an average mass of carcass of 70.4 kg. The slaughter weight of the pigs of the 1st and 2nd test groups averaged 76.62 and 77.48 kg, which is 6.22 and 7.08 kg higher than the control index.

Table 8 – Meat productivity of pigs

Index	Group of animals		
	control	1 st experimental	2 nd experimental
Preslaughter weight, kg	103.79	110.92	112.34
Absolute gain, kg	102.79	109.92	111.34
Average daily gain, g/day	489	523	530
Slaughter weight, kg	70.4±0.28	76.62±0.48	77.48±0.62
Slaughter yield, %	67.83	69.08	68.97

In addition to the absolute increase in the slaughter weight of pigs against the background of the use of immunotropic drugs, they also increased the slaughter yield. Thus, the slaughter yield in the pigs of the 1st and 2nd groups was 69.08 and 68.97%, which is 1.25 and 1.14% higher than the control index.

The muscular tissue of all the examined carcasses was well developed, especially on the dorsal and hip parts, the fat was mostly white, in some carcasses had a pale pink hue. The mass of carcasses of pigs of all groups was in the range from 39 to 98 kg inclusive, and the thickness of the lard over the spinous processes between the 6th and 7th thoracic vertebrae was in the range of 1.5 to 4.0 cm, not counting the thickness of the skin. Therefore, according to GOST 7724-77 "Meat. Pork in carcasses and half carcasses, "pork derived from animals of all study groups should be classified as Category II (young meat).

After separation of the carcasses into halves and cooling in the refrigerator at a temperature of -3...-5 °C and an airspeed of 1 to 3 m/s for 10 to 13 hours, the pork on the bones obtained from all three groups was directed to the boning and lining. The results of boning and pork are presented in table 9.

Table 9 – Debarking and lining of pig half carcasses

Index	Group of animals		
	control	1 st experimental	2 nd experimental
Weight of the chilled half carcasses, kg	34.74±0.13	37.78±0.24	38.22±0.31
trimmed pork, kg	21.65	23.53	23.81
Lard, kg	4.93	5.36	5.43
Skin, kg	2.36	2.57	2.60
Ribs for smoking, kg	3.13	3.40	3.44
Tendons, cartilages, kg	0.66	0.72	0.73
Technical cleaning and losses, kg	0.07	0.08	0.08
Bone, kg	1.95	2.12	2.14

Half-carcasses from all three groups corresponded to the hygienic requirements for safety and nutritional value of slaughter animals meat. So, on all the samples a crust of drying of a pale pink color was well pronounced. The muscles on the incision were wet to the touch, but they did not leave a wet spot on the filter paper, the color corresponded to benign pork and was from light pink to red. The consistency of the meat was elastic, the fossa formed when pressing with a finger, quickly formed up. The smell was specific, peculiar to pork. The fat was mostly white in color, sometimes pale pink. Consistency is soft, elastic. Tendons were dense, elastic, with a smooth, shiny articular surface.

As can be seen from the presented table, the boning and trimming of carcasses did not reveal a significant increase in the yield of individual components, but at the same time, the amount of trimmed pork significantly increased. Thus, the mass of chilled half-carcasses in the skin, with a cut, without pots and without legs of the pigs of the 1st and 2nd experimental groups, was more than the control half-carcass weight by 3.04 and 3.48 kg. In this connection, it is quite understandable that the amount of trimmed pork obtained from the pigs of the experimental groups has also increased. Thus, the amount of trimmed pork obtained from half carcass of the pig of the 1st group was 1.88 kg more than the control index, and the 2nd group by 2.16 kg. In addition, the half carcass of the 1st and 2nd groups increased the amount of lard obtained by 0.43 and 0.50 kg, and the ribs for smoking - by 0.27 and 0.31 kg, respectively. In connection with the increase in the live weight and, correspondingly, the mass of the half carcasses of the pigs of the experimental groups, the amount of skin, tendons and cartilages, bone and technical losses obtained has also increased.

After boning, the content of basic nutrients and the energy value of medium samples of trimmed pork were determined (table 10).

As can be seen from the table, the content of basic nutrients and the energy value of pork of all three groups also corresponded to the category II pork. However, it should be noted that the protein content was significantly higher in the meat in experimental groups. Thus, the protein content in 100 g of pork of the 1st group was higher than the control value by 0.50 g, and the second one by 0.66 g. In addition, in the meat of the pigs of the experimental groups, there was a lower fat content, 1.92 g in the 1st experimental

Table 10 – Content of basic nutrients and energy value of pork

Index	Group of animals		
	control	1 st experimental	2 nd experimental
Water, g in 100 g of pork	52.51±0.11	52.84±0.22	52.62±0.48
Proteins, g in 100 g of pork	14.32±0.08	14.82±0.17*	14.98±0.16**
Fats, g in 100 g of pork	33.32±0.13	31.40±0.10***	31.46±0.46***
Ash, g in 100 g of pork	0.96±0.04	0.94±0.04	0.94±0.05
Energy value, kcal per 100 g of pork	356.40±2.29	360.20±1.24	359.40±2.25
* P<0.05; ** P<0.01, *** P<0.001.			

and 1.86 g in the 2nd experimental group. The difference in the energy value of pork from the three groups was statistically unreliable.

In such a way, it can be concluded that intramuscular injection to piglets in the early period of the postnatal ontogeny of the PigStim-C and PigStim-M immunotropic preparations promoted an increase in their meat productivity. Thus, from the pigs of the experimental groups, a greater amount of meat was obtained, both on bone and trim, in addition, in the meat of the pigs of the experimental groups, the protein content significantly increased and the fat content decreased.

Discussion. Essential influence on the productive qualities of pigs is provided by the conditions of keeping and feeding, and the development of pig production should mean the development and introduction into the production process of effective technologies for keeping, feeding and maintenance of animals that increase productivity, improve the quality of the received products and the profitability of the industry as a whole. But often in practice, new developments and innovations violate the relationships of the pig's organism with the environment and the traditional conditions of keeping and feeding that have developed during phylogenesis. Under such conditions, negative environmental factors are constantly acting on the organism of pigs, which leads to a disruption in metabolism, a decrease in organism resistance and, ultimately, a high incidence and low pork livestock.

In order to ensure the health, safety and increase in the productivity of pigs, modern scientists and practicing veterinarians recommend the use of a variety of biologically active substances. The modern veterinary pharmaceutical market offers a wide range of such products, but based on the analysis of the available literature on this subject, it can be concluded that the effectiveness of the proposed tools is inadequate. The main reasons for this are the lack of comprehensive action, high cost, the availability of restrictions on the use of products against their background, and others. At the same time, the immunotropic preparations such as PigStim-C and PigStim-M, developed by scientists of the Chuvash State Agricultural Academy V.G. Semenov, F.P. Petryankin and others.

This research work is devoted to the scientific and practical substantiation of the expediency of activating the nonspecific resistance of pigs with the PigStim-C and PigStim-M new immunotropic drugs in order to realize the bioresource potential of their organisms.

Against the backdrop of intramuscular injection of PigStim-C and PigStim-M in the early period of the postnatal ontogenesis, the increase in the number of erythrocytes and the increase in the concentration of hemoglobin in the blood of piglets from experimental groups is observed, which indicates the activation of hematopoiesis in their bodies.

Also, on the back of intramuscular injection of immunotropic preparations PigStim-C and PigStim-M, leukocytosis is observed, not exceeding physiological norms, with pronounced lymphocytosis amid a rise in the number of basophils and neutropenia with a nuclear shift to the right, and the analysis of the protein profile established a significant increase in serum piglets concentrations of total protein due to globulin, mainly γ -globulin fraction.

With the use of immunotropic drugs, cellular and humoral factors of the nonspecific resistance of the piglets are activated.

Analysis of the incidence and safety of pigs during periods of sowing, weaning and fattening at the pig breeding complex of Progress CJSC, revealed the effectiveness of PigStim-C and PigStim-M preparations in ensuring the health and safety of pigs. With their use, the number of diseases among piglets

decreased by 2.36-2.89 times during the sowing period, and their duration decreased by 14.8-20.9%. During weaning, the disease was 2.0-2.8 times less, and its duration was shorter by 17.7-23.5%. During the fattening period, the incidence decreased by 1.5-1.7 times, while the duration decreased by 11.4-12.0%. It should be noted that the safety of the pigs of the 1st and 2nd experimental groups was 98.0 and 100.0% with 94.0% of the piglets in the control group.

Live weight of pigs on the back of the use of the immunotropic preparations PigStim-C by the end of the fattening period was equal to the average for the group of 110.92 kg, which is 7.13 kg or 6.87% higher than the control value. Live weight of pigs against the background of PigStim-M also turned out to be larger than the control indicator, but by 8.55 kg or 8.24%, and the average for the group was 112.34 kg. The average daily weight gain of pigs on the background of immunocorrection with PigStim-C was higher than the control values for the 1st, 2nd, 3rd, 4th, 5th, 6th and 7th months of growth by 15 g, 19, 27, 33, 43, 49 and 52 g, and the immunotropic drug PigStim-M at the same time - by 17 g, 24, 32, 41, 49, 58 and 64 g respectively. The average daily gain of pigs on average for the entire period of the experiment increased by 34 and 41 g day. Consequently, the use of PigStim-C and PigStim-M immunotropic preparations in piglets in the early postnatal ontogenesis promotes their growth during periods of sowing, weaning and fattening.

According to the results of control slaughter, the slaughter yield in pigs with immunocorrection was higher than the control one by 6.22 kg with PigStim-C and 7.08 kg with PigStim-M. In addition to the absolute increase in slaughter weight against the background of the use of immunotropic drugs, the slaughter yield also increased by 1.25 and 1.14%, respectively.

The mass of chilled half-carcasses in skin, with a cut, without pots and without legs of pigs after application of the immunotropic preparations PigStim-C and PigStim-M was more than the weight of control half-carcasses by 3.04 and 3.48 kg. The amount of pork obtained from one half of the pig after application of PigStim-C was 1.88 kg more than the control value, and after applying PigStim-M - by 2.16 kg. From half carcasses of the pigs subjected to immunocorrection, the amount of the obtained lard increased by 0.43 and 0.50 kg and the edges for smoking by 0.27 and 0.31 kg. In connection with the increase in the live weight and, correspondingly, the mass of the half-carcasses of the pigs of the experimental groups, the amount of skin, tendons and cartilages, bone and technical losses obtained has also increased.

A significant increase in the protein content and a decrease in the amount of fat in the pigs of experimental groups was detected. Consequently, the protein content in 100 g of pork of the 1st group was higher than the control value by 0.50 g, and the 2nd group - by 0.66 g, and the fat content was less by 1.92 g in the 1st experimental and by 1.86 g in the 2nd experimental group.

In such a way, it can be concluded that intramuscular administration of immunotropic drugs PigStim-C and PigStim-M to piglets in the early period of the postnatal ontogeny promoted an increase in their meat productivity. Thus, from the pigs of the experimental groups, a greater amount of meat was obtained, both on bone and trim, in addition, in the meat of pigs of experimental groups, the protein content significantly increased, and the fat content decreased.

Conclusion. The conducted research work confirms the expediency of immunological correction of the piglets in the early period of postnatal ontogenesis with immunotropic preparations PigStim-C and PigStim-M in order to realize the bioresource potential of their organisms. Against the backdrop of the triple intramuscular injection of immunotropic drugs, with an interval of three days on the 1st, 4th and 7th day of life at a dose of 0.3 ml per head, there is a significant increase in growth rates, and the safety of young animals, the amount of pork obtained increases, in the absence of a negative effect on the clinical and physiological state of the pig's organism and the sanitary quality of the products.

Withdrawal

1. The microclimate parameters in the premises for keeping pigs during the periods of sowing, weaning and fattening were within the limits of zoohygienic norms according to RD-APK 1.10.02.04-12 and satisfied the biological needs of the corresponding age group of animals.

Pigs feeding was carried out by balanced mixed fodders based on a grain mixture of own production and concentrates produced by Premikorm OOO.

2. Developed immunotropic drugs do not have a negative effect on the clinical and physiological state of the pig's organism, ensure the health and safety of pigs.

The use of PigStim-C and PigStim-M contributed to a 1.5-2.9 times decrease in the number of diseases and a reduction in the recovery period by 11.4-23.5%. The increase in the safety of pigs in the 1st and 2nd experimental groups up to 98.0 and 100.0% at 94.0% in the control was established.

3. The immunotropic preparations PigStim-C and PigStim-M activate hemopoiesis, causing a positive dynamics of hematological and biochemical profiles of pigs in ontogeny.

After the application of these immunotropic drugs, there is a significant increase in the number of erythrocytes by 5.1-7.6% and 5.7-8.8% and as well as hemoglobin concentration by 3.1-5.3% and 2.9-4.9%, respectively, and leukocytosis, which does not exceed physiological norms with pronounced lymphocytosis against the background of the increase in the number of basophils and neutropenia with a nuclear shift to the right. The increase in the amount of total protein in the blood serum by 2.3-4.0% and 1.9-4.7% was due to activation of the production of globulins, predominantly the γ -globulin fraction of the protein, against the background of immunocorrection of the body with PigStim-C and PigStim-M preparations.

4. The use of immunotropic drugs in the early period of postnatal ontogenesis of pigs activates cellular and humoral factors of nonspecific defense of the organism in industrial technology: phagocytic activity of neutrophils - by 3.8-5.8% and 4.2-6.4%, bactericidal activity of blood serum - by 3.6-8.6% and 3.4-9.8%, lysozyme activity of blood plasma - by 4.8-8.6% and 4.0-8.0%.

5. Immunocorrection of piglets in the early period of postnatal ontogenesis with the immunotropic drugs promotes the realization of the bioresource potential of meat productivity.

The veterinary and sanitary examination established that the PigStim-C and PigStim-M immunotropic preparations do not adversely affect organoleptic, biochemical and spectrometric parameters of pork, and ensure its good quality.

It was found that the animals of the 1st and 2nd experimental groups outperformed their peers in control in live weight by 7.1 kg or 6.9% and by 8.6 kg or 8.2%, the average daily gain - by 34 and 41 g.

The slaughter yield of pigs against the background of immunocorrection with PigStim-C and PigStim-M was higher by 6.22 kg and 7.08 kg, rather than in the control.

According to the results of boning and trimming of the half-carcasses of pigs in the experimental groups, an increase in the amount of trimmed pork on 1.88 and 2.16 kg in the 1st and 2nd experimental groups was found in comparison with the control.

A significant increase in the protein content by 0.50 and 0.66% was found and a decrease in the amount of fat by 1.92 and 1.86% in the pigs of experimental groups was revealed.

Recommendations. With the aim of realizing the bioresource potential of pigs in industrial pig breeding, we recommend:

1. Newborn piglets intramuscularly, three times on the 1st, 4th and 7th day of life, to inject the immunotropic drug PigStim-C in a dose of 0.3 ml per head.

2. Piglets to intramuscularly inject the immunotropic drug PigStim-M at a dose of 0.3 ml per head three times at intervals of three days on the 1st, 4th and 7th day of postnatal ontogenesis.

The choice of the immunotropic drug should be carried out on the basis of pharmacological features, taking into account the clinical and physiological state of the piglets and the epizootological situation.

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**В. Г. Семенов¹, Д. А. Баймұқанов², В. Г. Тюрин³, Н. И. Кульмакова⁴,
Д. А. Никитин¹, К. Ж. Исхан⁵, М. Б. Қалмағамбетов², Х. Ә. Әубәкіров⁶**

¹Чуваш мемлекеттік ауылшаруашылық академиясы, Чебоксары, Чуваш Республикасы, Ресей,

²Қазақ мал шаруашылығы және азық өндірісі ғылыми-зерттеу институты, Алматы, Қазақстан,

³Ветеринарлық санитария, гигиена және экология бүкілресейлік ғылыми-зерттеу институты,
Мәскеу, Ресей,

⁴К. А. Тимирязева атындағы МАША – Ресей мемлекеттік аграрлық университеті, Мәскеу, Ресей,

⁵Қазақ ұлттық аграрлық университеті, Алматы, Қазақстан,

⁶Тараз ұлттық университеті М. Х. Дулати атындағы, Тараз, Қазақстан

ШОШҚА ӨНІМДІЛІГІНІҢ ПОТЕНЦИАЛЫН ІС ЖҮЗІНЕ АСЫРҒАНДА ЖАҢА ИММУНОТРОПТЫҚ ПРЕПАРАТ ОРГАНИЗМНІҢ ЕРЕКШЕ ҚОРҒАНЫСЫН БЕЛСЕНДЕНДІРЕДІ

Аннотация. Шошқа өсіретін кешенінің жағдайында жаңа туылған торайлардың биоресурстық өнімділік әлеуетін іске асыру мақсатында PigStim-C және PigStim-M иммунотропты препараттардың тиімділігін бағалау жүргізілді. PigStim-C және PigStim-M иммунотропты препараттары ағзаның клиника-физиологиялық жағдайына кері әсер етпейтіні, шошқалардың денсаулығы мен сақталуын қамтамасыз ететіні анықталды. Торайлар организмін иммунокоррекциялау барысында сырқаттардың 1,5-2,9 есе азайғаны, сауығу мерзімінің 11,4-23,5% қысқаруы, сандық сақталуы 98,0-100,0% дейін жоғарлады. Иммунотропты препараттарды қолдану шошқаның ерте онтогенез барысында ағзаның спецификалық емес жасушалық және гуморальдық қорғаныш факторларын активациялайды. Өндірістік технология жағдайларында: нейтрофилдердің фагоцитарлық белсенділігі – 3,8-5,8% және 4,2-6,4%, қан сарысуының бактерицидті белсенділігіне – 3,6-8,6% и 3,4-9,8%, қан плазмасының лизоцимді белсенділігіне – 4,8-8,6% и 4,0-8,0%. Торайлар организмін ерте онтогенез мерзімінде PigStim-C және PigStim-M иммунотропты препараттармен иммунокоррекциялау ет өнімділігіне оң әсер етеді. Бақылау тобымен салыстырғанда, 1 және 2 тәжірибиелі топтың жануарлары тірі салмақ бойынша олардан 7,1 кг немесе 6,9% және 8,6 кг немесе 8,2% басым болды, Орта тәуліктік өсім 34 және 41 г екендігі анықталды. Иммуноактивтеу аясындағы шошқаның салмағы бақылаудан 6,22 және 7,08 кг жоғары болды. Бақылаумен салыстырғанда, 1 және 2 бақылау топтарының сойыс шығымдары жоғары.

Түйін сөздер: шошқа, иммунотроптық препараттар PigStim-C және PigStim-M, иммунитет, ауру және қауіпсіздік, өнімділік.

**В. Г. Семенов¹, Д. А. Баймуханов², В. Г. Тюрин³, Н. И. Кульмакова⁴,
Д. А. Никитин¹, К. Ж. Исхан⁵, М. Б. Калмагамбетов², Х. А. Аубакиров⁶**

¹Чувашская государственная сельскохозяйственная академия, Чебоксары, Чувашская Республика, Россия,

²Казахский научно-исследовательский институт животноводства и кормопроизводства, Алматы, Казахстан,

³ВНИИ ветеринарной санитарии, гигиены и экологии, Москва, Россия,

⁴Российский государственный аграрный университет – МСХА им. К. А. Тимирязева, Москва, Россия,

⁵Казахский национальный аграрный университет, Алматы, Казахстан,

⁶Таразский государственный университет им. М. Х. Дулати, Тараз, Казахстан

АКТИВИЗАЦИЯ НЕСПЕЦИФИЧЕСКОЙ ЗАЩИТЫ ОРГАНИЗМА НОВЫМИ ИММУНОТРОПНЫМИ ПРЕПАРАТАМИ В РЕАЛИЗАЦИИ ПОТЕНЦИАЛА ПРОДУКТИВНОСТИ СВИНЕЙ

Резюме. В условиях свиноводческого комплекса проведена оценка эффективности применения иммунотропных препаратов PigStim-C и PigStim-M новорожденным пороссятам с целью реализации биоресурсного потенциала продуктивности. Установлено, что иммунотропные препараты PigStim-C и PigStim-M не оказывают негативное влияние на клинико-физиологическое состояние организма, обеспечивают здоровье и сохранность свиней. На фоне иммунокоррекции организма поросят отмечено снижение количества заболеваний в 1,5-2,9 раза, сокращение сроков выздоровления на 11,4-23,5%, повышение сохранности поголовья до 98,0-100,0%. Применение иммунотропных препаратов в раннем периоде постнатального онтогенеза свиней активизирует клеточные и гуморальные факторы неспецифической защиты организма в условиях промышленной технологии: фагоцитарной активности нейтрофилов – на 3,8-5,8% и 4,2-6,4%, бактерицидной активности сыворотки крови – на 3,6-8,6% и 3,4-9,8%, лизоцимной активности плазмы крови – на 4,8-8,6% и 4,0-8,0%. Иммунокоррекция организма поросят в раннем периоде постнатального онтогенеза иммунотропными препаратами PigStim-C и PigStim-M способствует реализации биоресурсного потенциала мясной продуктивности. Установлено, что животные 1-й и 2-й опытных групп превосходили сверстников в контроле по живой массе на 7,1 кг или 6,9% и на 8,6 кг или 8,2%, среднесуточному приросту – на 34 и 41 г. Убойная масса свиней на фоне иммунокоррекции оказалась выше контрольного на 6,22 и 7,08 кг. По результатам обвалки и жиловки полутуш свиней подопытных групп установлено увеличение количества жилованной свинины на 1,88 и 2,16 кг в 1-й и 2-й опытных группах по сравнению с контролем.

Ключевые слова: свиньи, иммунотропные препараты PigStim-C и PigStim-M, иммунитет, заболеваемость и сохранность, продуктивность.

About the authors:

Seменов Vladimir Grigoryevich, doctor of biological science, professor, honored worker of science of the Chuvash Republic, professor of department of morphology, obstetrics and therapy of the Chuvash state agricultural academy, Cheboksary, Chuvash Republic, Russia, e-mail: semenov_v.g@list.ru,

Baimukanov Dastanbek Asylbekovich, doctor of agricultural sciences, professor, corresponding member of the National Academy of Sciences of the Republic of Kazakhstan, chief researcher of department of cultivation and selection of the dairy cattle of the Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Almaty, Republic of Kazakhstan, e-mail: dbaimukanov@mail.ru,

Tyurin Vladimir Grigoryevich, doctor of veterinary sciences, professor, head of the laboratory of zoohygiene and environmental protection of the All-Russian Research Institute of veterinary sanitation, hygiene and ecology, Moscow, Russia, e-mail: potyemkina@mail.ru,

Kulmakova Natalia Ivanovna, the doctor of agricultural sciences, the associate professor, professor of department of morphology and veterinary science of the Russian state agricultural university – the Moscow agricultural academy named after K.A. Timiryazev, Moscow, Russia, e-mail: kni11@mail.ru,

Nikitin Dmitry Anatolyevich, candidate of veterinary sciences, associate professor of morphology, obstetrics and therapy of the Chuvash state agricultural academy, Cheboksary, Chuvash Republic, Russia, e-mail: nikitin_d_a@mail.ru.

Iskhan Kairat Zhalelovich, Candidate of Agricultural Sciences, associate professor, professor of the department "Technology of production of livestock products" of the faculty "Technology and Bioresources", Non-commercial Joint-Stock Company "Kazakh National Agrarian University". E-mail: kairat@mail.ru

Kalmagambetov Murat Baitugelovich, Candidate of Agricultural Sciences, Head of the Department of Feeding Livestock Animals, Limited Liability Partnership "Kazakh Scientific Research Institute of Animal Breeding and Fodder Production". E-mail: animal_feeding@mail.ru

Aubakirov Khamit Abilgazyevich, Candidate of Agricultural Sciences, Associate Professor of the Department of Biotechnology, M.Kh. Dulati Taraz State University, Taraz, Kazakhstan. E-mail: hamit_a57@mail.ru

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