

# Realization of reproductive and productive qualities' potential of pigs by organism's immunocorrection

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**Abstract.** The purpose of this work was to realize the reproductive qualities of sows and the productivity of young pigs with immunotropic preparations PigStim-C and PigStim-M. To set up the experiment, 30 heads of nursing sows were selected on the 15th day after the first farrowing. The selected sows were divided into 3 groups according to the breed, reproductive qualities and reproductive health according to the principle of pairs of analogues. It was found that intramuscular injection of the immunotropic drug PigStim-C to animals of the 1st experimental group (and PigStim-M to animals of the 2nd experimental group) at a dose of 5 ml per head on the 15th, 20th, and 25th day after farrowing contributes to: reducing the period from weaning to coming into heat and the onset of the optimal period for insemination by 4.5-9.1%; an increase in the success of insemination from 90% in the control group to 100%; an improvement in sows' prolificacy by 8.1-8.6% and a decrease in the number of stillborn piglets by 16.7-33.3%; a decrease in the number of sows with prolonged farrowing by 2-3 times resulting in a decrease in the occurrence of postpartum pathologies of reproductive organs, such as metritis-mastitis-agalactia syndrome, as well as an increase in the therapeutic measures' efficiency in case of their occurrence; a decrease in the disease incidence of young pigs obtained from these sows during the next farrowing by 36.8-41.5%, an increase in their viability by 1.45-2.97% and an increase in live weight at the end of the growing period by 0.16-0.18 kg, rearing – by 1.1-1.22 kg, and when removed from fattening – by 3.6-4.0 kg.

## 1 Introduction

Along with other branches of animal husbandry that provide meat products to the population of the country, pig farming suffers significant losses from problems that hinder the achievement of efficiency targets [1]. The problem of maintaining health and realizing the reproductive potential of the breeding stock remains one of the unsolved problems of modern industrial pig breeding [2]. The issue of achieving planned indicators of reproductive qualities is acute for veterinary specialists [3]. Currently, many methods and means have been developed that contribute to achieving the target indicators of reproductive and

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productive qualities of pigs, but only a part of them are produced by industry and is available on the commercial market; the efficiency of preparations available to the consumer is not always sufficient, the expediency of their use is often not economically justified [4, 5]. In the light of the above, it seems promising to develop, test and introduce new therapeutic and preventive means into practical veterinary medicine; such means ensure the preservation of health, the realization of productive and reproductive qualities of animals, the use of which would be economically feasible [6, 7].

The purpose of this work is to realize the reproductive qualities of sows and the productivity of young pigs with immunotropic preparations PigStim-C and PigStim-M.

## **2 Materials and methods**

The research work was carried out on the basis of the pig breeding complex of the Chuvash Republic. To set up the experiment, 30 heads of nursing sows were selected on the 15th day after the first farrowing. At the enterprise, piglets' weaning is carried out when they reach the age of 25 days. The selected sows were divided into 3 groups according to the principle of pairs of analogues according to the breed, reproductive qualities (age of first insemination, fertility of insemination, prolificacy, fetus size, duration of farrowing, etc.) and reproductive health. Animals of the 1st experimental group underwent intramuscular injection of the immunotropic preparation PigStim-C; animals of the 2nd experimental group received PigStim-M. Immunotropic preparations were injected into sows of the 1st and 2nd experimental groups according to the same scheme, three times on the 15th, 20th, and 25th days after farrowing at a dose of 5 ml per head. The indicated terms of immunotropic preparations' use are consistent with the scheme of vaccinations, preventive treatments and other technological measures. The sows of the control group were biological controls; they did not receive immunotropic preparations.

The conditions of keeping, feeding and maintaining the sows of the experimental groups were identical. When weaning piglets, sows were transferred to the insemination workshop, where they were kept in individual stalls. The movement of animals was carried out with the obligatory observance of the principle "All empty – all occupied". Methods of stimulation and detection of oestrus in sows in the context of groups did not differ. Artificial insemination of animals was performed after confirmation of oestrus presence by the "riding" test. The duration of the period from weaning piglets to the optimal time for insemination (coming into heat) was noted.

Insemination of sows was carried out by the non-fractional method with the seed of breeding boars of their own herd. Selection of boars for insemination was carried out following the principle of pairs of analogues. Sperm sampling and checking, preparation of the working semen solution was carried out in strict accordance with the approved technology of artificial insemination of sows. Insemination was carried out with plastic catheters 50 cm long allowing sperm to be injected deep into the cervix and excluding its leakage due to a special plastic sponge (tip) covering the cervical canal. Sows' insemination was carried out twice with an interval of 24 hours.

The diagnosis of pregnancy was carried out by ultrasound on the 24-28 day after insemination. Upon detection of pregnancy, the sows were transferred to a waiting room equipped with group stalls on the 28th day. 3-4 days before farrowing, the sows were transferred to the farrowing workshop. The sows were constantly monitored, signs of approaching farrowing were recorded. Obstetric measures were provided to the sows upon necessity.

During farrowing and in the nursing period, strict indicators' record of reproductive qualities and reproductive health of sows was carried out. The indicators of farrowing

duration, the nature of its course, the number of live-born and stillborn piglets, as well as the peculiarities of the postpartum period were recorded.

In young pigs obtained from sows of experimental groups, the indicators of the clinical and physiological state, growth dynamics and viability were taken into account during the periods of milking, nursery and fattening.

The growth dynamics of young pigs was assessed by the indicators of live weight and its average daily increments by group weighing using the scales VSP4-150 ZhSO (scales for piglets' weighing) and the scales MVSK S-NN-1.5 (1,5x1,5) with a fence for animal weighing. The weight of one head was calculated by dividing the mass of a group of animals by the number of animals in the group. The average daily live weight gains were calculated by dividing the difference in pig weights at the end and beginning of the record period by the number of days of the record period.

### 3 Results and discussion

Indicators of reproductive qualities of experimental groups' sows are presented in Table 1.

**Table 1.** Reproductive qualities and reproductive health of sows

Indicator	Group of animals		
	control	1st experimental	2nd experimental
Number of sows in the group	10	10	10
Duration of the period from weaning to insemination, days	4,4±0,24	4,2±0,20*	4,0±0,32*
Sows with the period's duration of more than 4 days from weaning to insemination, heads	4	2	1
Number of inseminated sows, heads	10	10	10
Successfully inseminated sows, heads	9	10	10
Insemination success, %	90	100	100
Successfully farrowed, heads	9	10	10
Farrowing duration, hours	4,3±0,54	3,2±0,34*	3,3±0,34*
Number of sows with farrowing lasting for more than 3 hours, head/%	6/66,6	2/20	3/30
The number of sows in need of obstetrics, heads	2/22,2	1/10	1/10
Number of sows with diagnosed postpartum complications, head/%	3/33,3	1/10	0/0
- of them recovered, head/%	3/100	1/100	–
Treatment efficiency, %	100	100	–
Prolificacy, heads	12,4±0,24	13,4±0,40	13,6±0,51
Stillborn, heads/sow	0,60±0,24	0,40±0,24*	0,50±0,24
Obtained piglets (total from the group), heads	112	134	136
Number of ablated piglets (from 1 sow), heads	12,0±0,32	13,2±0,37*	13,2±0,49
Ablated piglets (total from the group), heads	108	132	132
Mortality up to 25 days of age, heads/nest	0,4±0,24	0,2±0,20*	0,4±0,24
Viability up to 25 days of age, %	96,80±1,96	98,58±1,42	97,12±1,77
Live weight at weaning (25 days), kg	7,96±0,10	8,14±0,13	8,12±0,10

\*  $P \leq 0.05$ .

The period's duration from weaning to coming into heat and the onset of the optimal period for insemination in the context of groups varied. On average in the group, sows coming into heat of the control group was detected and insemination was performed  $4.4 \pm 0.24$  days after weaning their piglets. In the 1st and 2nd experimental groups, the duration of the period from weaning piglets to coming into heat and the onset of the optimal period for

insemination was reliably less than the control values by 0.2 and 0.4 days. In addition, it was found that the duration of the period from weaning piglets to coming into heat was more than 4 days in 4 sows of the control group, which is significantly higher than the values of the 1st and 2nd experimental groups (2 and 1 sows, respectively). Therefore, the injection of immunotropic preparations PigStim-C and PigStim-M helps to shorten the period from weaning to coming into heat and the onset of the optimal period for sows' insemination.

Ultrasound diagnostics of pregnancy revealed that out of 10 inseminated sows of the 1st and 2nd experimental groups, 10 heads from each group turned out to be pregnant, whereas pregnancy was diagnosed in 9 sows out of 10 inseminated ones in the control group. Consequently, the use of immunotropic preparations PigStim-C and PigStim-M contributes to the increase in the success of sows' insemination.

All pregnant sows of the experimental groups (9 in the control group and 10 in each experimental group) successfully farrowed. Nevertheless, a significant difference was revealed during the farrowing and the postpartum period. Thus, the farrowing duration in sows of the control group was longer than in animals of the 1st and 2nd experimental groups by 1.1 and 1.0 hours, respectively. In addition, the farrowing duration turned out to be more than 3 hours in 6 out of 9 sows of the control group, which is 46.6 and 36.6% or 2 and 3 times more than the values of the 1st and 2nd experimental groups, in which farrowing was delayed in 2 and 3 out of 10 sows, respectively. The sows were immediately provided with obstetrics in case of complications during farrowing. During farrowing, complications occurred in 2 sows of the control group, which is 2 times higher than the values of the 1st and 2nd experimental groups, in which only one sow from each group required delivery. Thus, by observing the farrowing course of experimental groups' sows, it was found that the immunotropic preparations PigStim-C and PigStim-M injected intramuscularly to sows in the nursing period before weaning contribute to the physiological course of the generic farrowing process and prevent the occurrence of complications during farrowing.

Further observation revealed that the course of the postpartum period in most of the sows of the experimental groups was physiological; however, the average picture in the context of the groups differed. Thus, among the sows of the control group, the course of the postpartum period in 3 heads proceeded with the development of pathological processes characterized by symptoms of the metritis-mastitis-agalactia syndrome. At the same time, among the sows of the 1st experimental group against the background of using the immunotropic preparation PigStim-C, pathologies of the course of the postpartum period were diagnosed only in 1 sow, whereas among the animals of the 2nd experimental group against the background of the use of PigStim-M, metritis-mastitis-agalactia syndrome was not diagnosed. Animals of the control and 1st experimental groups were immediately treated when the disease was diagnosed; therapeutic measures were effective in 100% of cases.

By stating the indicators of reproductive sows' qualities, it was found that against the background of the using immunotropic preparations PigStim-C and PigStim-M, the prolificacy increased by 8.1 and 9.7%, respectively. It should be particularly noted that with 100% insemination success of experimental groups' sows against the background of immunoprophylaxis and with 90% in the control group, 22 and 24 more piglets were obtained from sows of the 1st and 2nd experimental groups than from sows of the control group. The number of stillborn piglets also turned out to be less in sows of the experimental groups by 33.3 and 16.6%.

Indicators of morbidity and viability of young pigs obtained from sows of experimental groups are presented in Table 2.

**Table 2.** Morbidity and viability of young pigs

Indicator	Group of animals		
	control	1st experimental	2nd experimental
Number of piglets at birth, heads	112	134	136
Sick suckling piglets, heads	63	43	39
Of them recovered	59	41	35
Dead until 25 days of age, heads	4	2	4
Viability up to 25 days of age, %	96,43	98,51	97,06
Number of piglets at weaning at the age of 25 days, heads	108	132	132
Sick weaning piglets, heads	24	14	11
Of them recovered	23	14	11
Dead during growing period, heads	1	0	0
Viability of weaning piglets, %	99,07	100,00	100,00
Viability for the entire period of growing and rearing, %	95,54	98,51	97,06
Transferred to the fattening shop, heads	107	132	132
Sick during fattening period, heads	19	10	12
Of them recovered	19	10	12
Viability of fattening pigs, %	100,00	100,00	100,00
Viability for the entire period, %	95,54	98,51	97,06
Removed from fattening, heads	107	132	132

Of 112 piglets received from 9 sows of the control group, 63 were diagnosed with diseases during the nursing period. In the 1st experimental group, diseases were detected in 43 out of 134 suckling piglets, and in the 2nd experimental group - in 39 out of 136. Thus, the disease incidence of suckling piglets of the control group was higher than the values of the 1st experimental group by 24.16%, and the 2nd experimental group - by 27.57%. The course of diseases in suckling piglets of all groups did not differ and was characterized by symptoms of dyspepsia syndrome. The treatment of all piglets was identical and consisted in the use of antibacterial preparations. At the same time, 59 out of 63 sick piglets of the control group were cured, 4 suckling pigs were dead. Among the sick piglets received from sows of the 1st and 2nd experimental groups, 41 out of 43 and 35 out of 39 were cured, respectively. Thus, the analysis of veterinary and statistical reports indicates that the use of PigStim series immunotropic preparations for sows in the postpartum period contributes to the prevention of diseases and improving the viability of piglets obtained during subsequent farrowing.

After weaning and during the rearing period, diseases of non-infectious etiology (bronchitis, edematous disease of piglets, etc.) were also sporadically diagnosed among weaning piglets. All sick animals were provided with medical assistance according to the scheme adopted by the farm.

During the rearing period, 24 out of 108 weaning piglets of the control group fell ill, while 14 out of 132 piglets of the 1st experimental group fell ill, and 11 out of 132 animals of the 2nd experimental group were diagnosed with diseases. Consequently, among the piglets of the 1st and 2nd experimental groups, diseases were less during the period of rearing by 10 and 13 cases, respectively, or by 11.6 and 13.9%. The therapy of all sick piglets of the experimental groups was successful.

The fattening period also did not go without the occurrence of pig diseases. Pigs' diseases during this period were mainly characterized by coughing without an increase in body temperature and without deterioration of the general clinical and physiological condition (bronchitis of non-infectious etiology). In addition, joint pathologies (arthritis) were quite often registered among pigs during the fattening period. In general, during the fattening

period, 19 diseases were diagnosed among the animals of the control group, while in the 1st experimental group there were only 10, and in the 2nd experimental group – 12. In the control group, the disease incidence of young animals during the fattening period was 17.8%, while in the 1st and 2nd experimental groups, the analyzed indicator was lower by 10.2 and 8.7%, respectively, and had values equal to 7.6 and 9.1%.

During the fattening period, there was no mortality of young pigs in the experimental groups, the viability was 100%. On average during the entire period of growing, rearing and fattening of 112 piglets of the control group, 107 heads were removed from fattening, 5 heads died. Out of 134 and 136 piglets received from sows of the 1st and 2nd experimental groups, 132 heads from each group were removed from fattening. Consequently, the viability of young pigs by the end of the fattening period in the 1st and 2nd experimental groups was higher than the values of the control group by 2.97 and 1.52%, respectively.

The growth dynamics of young pigs is presented in Table 3.

**Table 3.** Growth dynamics of pigs

Indicator	Group of animals		
	control	1st experimental	2nd experimental
<b>Live weight, kg</b>			
At weaning at the age of 25 days	7,96±0,10	8,14±0,13	8,12±0,10
At the end of growing period, 71 days	31,52±0,30	32,62±0,17*	32,74±0,23*
At the end of fattening period, 171 days	120,6±0,93	124,2±1,07*	124,6±0,93*
<b>Average daily gain, g</b>			
Per nursing period	278,4±4,12	285,6±5,15	284,8±3,88
Per growing period	512,2±4,37	532,2±2,35**	535,2±3,85**
Per fattening period	890,8±7,83	915,8±9,81*	918,6±7,59*
On average for all periods	699,4±5,38	720,4±6,26*	722,8±5,43*

\* P<0,05; \*\* P<0,01.

The live weight of piglets against the background of intramuscular injection of PigStim-C and PigStim-M immunotropic preparations to sows during weaning was higher than the control values by 0.18 and 0.16 kg.

During the period of rearing and fattening, the young pigs of the experimental groups also grew more intensively than the control peers; besides, the difference in live weight indicators at the end of these periods was statistically significant. Thus, the average daily gains in live weight of young pigs of the 1st and 2nd experimental groups during the rearing periods were higher than the control values by 20.0 and 23.0 g, and during the fattening period - by 25.0 and 28.0 g.

## 4 Conclusion

The results of the research work indicate a positive effect of the immunotropic preparations PigStim-C and PigStim-M on the reproductive qualities of sows, the growth indicators and meat productivity of piglets obtained from them. Thus, intramuscular injection on the 15th, 20th, and 25th day after farrowing of PigStim immunotropic preparations contributes to:

- reduction of the period from weaning to coming into heat and the onset of the optimal insemination period by 4.5-9.1 %;
- increase in the success of insemination from 90 % in the control group to 100 %;
- improvement of the prolificacy indicator by 8.1-8.6% and reduction of the number of stillborn piglets by 16.7-33.3 %;
- reducing the number of sows with prolonged farrowing by 2-3 times resulting in reducing the occurrence of postpartum pathologies of the reproductive organs, such as

metritis-mastitis-agalactia syndrome, as well as increasing the effectiveness of therapeutic measures, if any;

- reducing the disease incidence of young pigs obtained from these sows during the next farrowing by 36.8-41.5%, increasing their viability by 1.45-2.97% and increasing live weight at the end of the growing period by 0.16-0.18 kg, rearing – by 1.1-1.22 kg, and when removed from fattening – by 3.6-4.0 kg.

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