Sexual Stimulation of Sows as One of the Factors of Increasing the Provision with Pork the Population of the Russian Federation

A Lishchuk¹, N Malakhova¹ and O Piskunova¹

¹Oryol State Agrarian University named after N.V. Parakhin, 69, General Rodin Street, Orel 302019, Russian Federation

E-mail: malahova-n@mail.ru

Abstract. Today the development of pig breeding is one of the most perspective lines in animal husbandry, capable of providing the population with high-quality and affordable agricultural products. One of the ways to improve the efficiency of pig breeding is increasing the productivity of animals. The increasing of animals’ productivity is possible only with using of deep knowledge of the relationship between organism and the environment. New reproduction technologies, keeping and hog growing are inevitably accompanied by industrial stresses, which create the preconditions for a weakening of the overall condition of the body and decrease in hormonal status, which leads to a violation of the ovulatory response of the ovaries, a lessening conception rate and sows birth rate, to lengthening of the pork production cycle, and to decreasing in the profitability of the industry. The article describes the results of studies carried out in the conditions of LLC "Znamensky SGC" of the Oryol region, on the study of the hormonal status of sows, diagnosed with ovarian hypofunction and a method of its correction for the formation of full sexual cycle.

1. Introduction

The strategic goal of the food security of the Russian Federation is the reliable provision of the population with safe and high-quality agricultural products [8, 19]. The stability of domestic production, as well as the availability of the necessary reserves and stocks is the guarantee of its achievement [1, 11].

Pork production is one of the leading branches of Russian meat production, since it has a shorter production cycle compared, for example, to beef production and, as prematurely developed branch of animal husbandry, is capable to solve the problem of meat production in the country on the basis of intensification and to provide the population with a safe, high-quality and affordable agricultural products and food accordance with rational norms of food consumption [12, 17]. High conception rate and early maturity of pigs contribute to the widespread use of this species of animals in all countries of the world. Nowadays, pork occupies 35-50% of the total meat purchases in the world and in our country [10]. Many economic and organizational factors influence the increasing of pig products production and its competitiveness. At the same time, in the conditions of industrial complexes for the pork production, there are factors such as vitamin deficiency, lack of insolation, exercise, chronic industrial stresses, which lead to a lack of estrus in gilts and sows, decrease their conception rate and
birth rate, and prolongate the pork production cycle, which generally reduces the profitability of the industry [5, 6].

It is known that chronic stress under industrial technology in animals reduces the secretion of luteinizing hormone (LH) in sows, which leads to dysfunction of the ovulatory response of the ovaries, accompanied by atresia of preovulatory follicles, prolonged ovulation over time, and a decrease in the number of ovulated follicles [2, 7, 18].

In gilts that have reached the age of insemination, and sows after piglets weaning with a prolonged absence of estrus as a result of ovarian hypofunction, anaphrodisia, “quiet” estrus or depressed conception rate, when other methods of stimulating sexual function are ineffective, stimulation with hormonal and other drugs is used. These drugs are used both separately and in various combinations [3, 4, 23, 24].

2. Materials and methods

The material for the study were Large White sows aged 1–1.5 years, the first month after farrowing, belonging to the pig complex of the LLC Znamensky SGC, of the Livny district, of the Orel region. During the production cycle, animals undergo periodic rearrangements according to age and physiological state. Active exercise was not provided by the animal management technology.

According to the results of the clinical examination, carried out in 2018 - 2019, of all the identified diseases of non-communicable etiology, 39% were gynecological diseases, 14% of which were ovarian hypofunction.

10 heads of sows with a diagnosis of ovarian hypofunction were selected for the experiment, and two experimental groups of 5 heads each according to the principle of paired analogs were formed.

To study the hormonal status of sterile animals, blood tests were carried out. Blood was collected from the jugular vein into vacuum tubes in the morning before feeding the animals. A blood test for hormonal status was carried out at the Livny Interdistrict Veterinary Laboratory according to the following indicators: the content of follicle-stimulating hormone (FSH), luteinizing hormone (LH), progesterone, estradiol, testosterone.

During rectal examination, it was found that in sterile sows with absence of estrus, ovaries were small in size, dense in consistency, while follicles and yellow bodies in the ovaries were not found.

Results and analysis of our own research.

3. Results and discussion

Studies of the hormonal status of sterile sows indicate a decrease in the level of hormones in the blood, which play an important role in the formation of the sexual cycle of pigs.

According to the results of our study of the blood serum of sows with ovarian hypofunction, a significant (by 22.69%) decrease in the level of follicle-stimulating hormone was found. Indicators of luteinizing hormone, progesterone, estradiol were lower than the physiological norm by 8.03%; 9.81%; 10.97% and 10.0%. The testosterone content was within the reference range.

To normalize the hormonal status and stimulate the estrus of sows, the drugs PG 600 and Follimag, which affect the growth and development of follicles and their ovulation in females were used. PG-600 is a combined hormonal drug manufactured in the Netherlands, containing 400 IU of pregnant mare serum gonadotropin (PMSG) and 200 IU of human chorionic gonadotropin (hCG) as active ingredients. Serum gonadotropin stimulates follicular development, and chorionic gonadotropin promotes ovulation and corpus luteum formation. The combination of these hormones contributes to the development of full reproductive cycles in pigs [20, 21, 22].

Follimag (Follimag) is a domestic drug containing gonadotropic hormone of the blood serum of pregnant mares (PMSG), purified from immunogenic proteins - 500 IU / vial and 1000 IU / vial. PMSG has both follicle-stimulating and luteinizing activity and does not have interspecies specificity.

Sows of the first experimental group the drug "PG-600" in 1 dose / head, which contains 400 IU of gonadotropin of pregnant mare serum (PMSG) and 200 IU of human chorionic gonadotropin (hCG) were injected intramuscularly once.
Table 1. The results of the study of the blood serum of pigs with ovarian hypofunction for hormonal status.

| № group | № | FSH, mIU/L | LH, mIU/L | Progesterone, nmol/l | Estradiol, nmol/l | Testosterone nmol/l |
|---------|---|------------|-----------|---------------------|------------------|-------------------|
| First group | 1 | 9.4* | 8.5* | 33.6 | 73.5** | 0.85 |
|          | 2 | 10.8 | 8.7 | 33.3 | 72.7 | **0.98 |
|          | 3 | 9.5* | 8.9 | 32.4 | 74.1 | 0.96 |
|          | 4 | 11.4 | 8.2* | 32.1 | 76.2** | 0.85 |
|          | 5 | 11.1 | 8.4 | 32.9 | 75.1 | **0.93 |
| Second group | 1 | 10.2* | 8.3 | 33.5 | 73.6 | 0.98 |
|           | 2 | 9.3 | 8.7* | 32.2 | 72.8 | **0.93 |
|           | 3 | 11.2 | 9.2 | 32.3 | 73.2** | 0.85 |
|           | 4 | 11.3* | 8.8 | 33.6 | 72.7 | **0.98 |
|           | 5 | 9.4 | 9.0 | 33.8 | 73.2 | 0.92 |
| Reference range | 12-15 | 9-13 | 34-36 | 76-89 | 0.9-1.2 |

Note: * - P <0.01; ** - P <0.05

The sows of the second experimental group a single injection of Follimag 1 dose / head containing 500 IU of gonadotropin in the blood serum of pregnant mares were injected intramuscularly.

On the 6th day after the drugs’ injection to study their effect on the hormonal status of sows, blood samples were taken from pigs of both experimental groups (Table 2).

Table 2. Results of blood tests for the level of hormones of sows on the sixth day of treatment.

| № group | FSH, mIU/L | LH, mIU/L | Progesterone, nmol/l | Estradiol, nmol/l | Testosterone nmol/l |
|---------|------------|-----------|---------------------|------------------|-------------------|
| First group | 14.1±1.3* | 12.2±1.2* | 33.2±2.7* | 85.3±13.4** | 0.95±0.06** |
| Second group | 13.2±1.3* | 11.3±1.2* | 33.5±2.7* | 83.3±11.2** | 0.91±0.14** |
| Reference range | 12-15 | 9-13 | 34-36 | 76-89 | 0.9-1.2 |

Note: * - P <0.01; ** - P <0.05

After the injection of "PG 600" in animals of the first experimental group, an increase in the level of follicle-stimulating hormone by 35.05%, luteinizing hormone - by 42.86%, progesterone - by 1.03%, estradiol - by 14.77% was observed.

In the second experimental group, the injection of "Follimag" caused an increase in the level of follicle-stimulating hormone by 28.41%, luteinizing hormone - by 28.40%, progesterone - by 1.27%, estradiol - by 13.64%.

Testosterone levels in both groups remained within the physiological norm.

Table 3. Research results after the use of drugs.

| Animal group | Estrus | Insemination efficiency |
|--------------|--------|------------------------|
|              | Number of heads | % | Number of heads | % |
| First group  | 4     | 80 | 5  | 100 |
| Second group | 3     | 60 | 4  | 80  |
In the group where the hormonal status was corrected with the “PG 600”, 4 out of 5 sows had estrus, which was 80%. When the hormonal status was corrected with Follimag, 3 out of 5 sows had estrus, which was 60%.

Pregnancy was diagnosed on the 20 day after insemination by the rectal method using an ultrasound study. In the experimental group, where the "PG 600" was injected, the insemination efficiency was 100% (pregnancy was determined in all 5 animals in the group). And in the group where the drug "Follimag" was injected, pregnancy was determined in 4 sows out of 5 (insemination efficiency 80%).

4. Conclusions
The conducted studies allow us to draw the following conclusions:

1. Intensification of pig breeding, concentration of production, expansion of existing pig breeding enterprises with the introduction of modern industrial technologies are accompanied by chronic industrial stresses, which inevitably leads to a decrease in conception rate and birth rate of sows, lengthening of the pork production cycle, and, in general, to decreasing in the profitability of the industry.

2. The use of hormonal stimulation in the first week after farrowing causes the growth of follicles in the ovaries, leads to the activation of the sexual function of pigs, makes it possible to achieve an earlier estrus of sows and increase the percentage of their conception rate.

3. The study of the comparative effectiveness of the use of hormonal drugs "PG 600" and "Follimag" showed that 100% therapeutic efficiency of insemination is achieved when hormonal stimulation is carried out with the drug "PG 600".

4. The effectiveness of veterinary measures per 1 ruble of costs for hormonal stimulation with PG 600 was 87.0 rubles, for hormonal stimulation with Follimag - 84.0 rubles.

Thus, the use of the hormonal drug "PG 600" for ovarian hypofunction is biologically justified and practically confirmed by a high therapeutic effect on the example of its use in LLC "Znamensky SGC" of the Oryol region, the Livny district.

5. References
[1] Babichev V N 2009 Neurohumoral regulation of the ovarian cycle (Moscow: Medicine) 237
[2] Breslavets V M, Khokhlov A V 2013 The effectiveness of various hormonal drugs in the normalization of ovarian dysfunction Izvestiya Orenburg State Agrarian University (Orenburg) 3(41) 252-254
[3] Buyantueva D T 2014 Biotechnological methods of intensification of pig breeding: author. diss. ... cand. s.-kh. Sciences (Ulan-Ude) 19 p
[4] Vodianikov V D 2011 Prolificacy of sows Veterinary of farm animals 5 pp 36-39
[5] Gorizontov P D 2008 Stress: the blood system in the mechanism of homeostasis (Moscow: Medicine) 84 p
[6] Ilyuchik A K 2012 Influence of beta-blockers and agents of natural origin on physiological and biochemical status and indicators of the formation of reproductive function of gilts: dis. ... Cand. biol. Sciences: 03.03.01: it was proved 05/29/2012 (Orel)
[7] Kotsarev V N 2002 Method of double use of domestic drugs of prostaglandin F-2α for the prevention of endometritis and MMA in pigs Mat. int. conf. Actual problems of diseases of young animals (Voronezh) pp 331-33223 Bibliography: pp 98 -112
[8] Lishchuk A, Malakhova N, Piskunova O 2019 Stimulation of sexual function of cows as a method of herd reproduction Increase Conference on Innovations in Agricultural and Rural development IOP Conf. Series: Earth and Environmental Science 341 (2019) 012046
[9] Perevoiko Zh A, Kosilov V I 2014 Basic biochemical parameters of the blood of boars and sows of large white breed Izvestiya of the Orenburg State Agrarian University (Orenburg) 5 pp 196-199
[10] Perepelyuk A P, Sopova Yu S 2013 Maprelin XP10 will tighten the timing of insemination,
synchronizing farrowing *Pig breeding* 5 pp 61-62

[11] Plemyashov K V, Zakharov P G, Suller I L, Oleksiyevich A A 2013 Problems of the reproduction of cattle *Ways of solution Tutorial* p 129

[12] Piskunova O G, Kleimyonova N V, Malakhova N A, Smagina T V, Lishchuk A P 2013 The ways of increasing the effective potential of the cattle dairy productivity in the Orel region under *The conditions of russia's wto accession Vestnik OrelGAU* vol 6(45) pp 68–70

[13] Protasov B I, Komissarov I I 2012 The strategy of using adaptogens to stimulate productivity in farm animals *Agricultural biology. Series Animal Biology* 6 pp 12-23

[14] Rabiee A R, Lian I J and Stevenson M A 2005 Efficacy of Ovsinch Program on Reproductive Performence in Dairy Cattle: A Meta-Analysis *J. of Dairy Sci.* p 89 2754

[15] Stevenson J S, Phatak A P 2005 Insemination at a astrus Induced by Ppre-synchronization before Fpplication of Synchronized estrus and Ovulation *J. of Dairy Sci.* p 88 399

[16] Slobodyanik V I, Stepanov V A, Melnikova N V 2014 Drugs of various pharmacological groups *Mechanism of action* (St. Petersburg: Lan Publishing House) 368 p

[17] Seredin V A 2006 Sexual cycle and neurohumoral regulation of reproductive function *Agrarian Russia* 4 pp 18–24

[18] Tkachenko Yu V, Minasyan V D 2014 Hormonal methods of stimulating the reproductive function of cows *Veterinary of farm animals* 3 pp 36-39

[19] Topuria L Yu 2012 The main reasons of the low reproductive ability of cows *News of the Orenburg State Agrarian University* 4 vol (36-1) pp 76–77

[20] Khlopitsky V P, Ushakova L M, Repin A V 2012 Problematic sows? Use Follimag! *Pig breeding number* 3 pp 59-60

[21] Khlopitsky V P 2012 Stimulation and synchronization of sexual function in gilts *Pig breeding* 8 pp 63–65

[22] Huen U, Hilgers I 2009 Estrus - on schedule: Using biotechnology to influence reproductive processes increases the efficiency of piglet production *New Agriculture* 5 pp 96-99

[23] Shishkin O V 2016 We control the process of reproduction of the herd *Pig breeding* 6 pp 90-91

[24] Manusov V Z, Antonenkov D V, Solovev D B 2018 Estimation of Energy Consumption of DM-H Drill Rig Main Drive in Far North Conditions 2018 *International Multi-Conference on Industrial Engineering and Modern Technologies (FarEastCon)* [Online]. Available: http://dx.doi.org/10.1109/FarEastCon.2018.8602484