Special compound feeds and an immunostimulator to increase the live weight gain of suckling piglets

A Lavrentev1,*, G Larionov1, L Mikhaylova1, L Zhestyanova1 and V Sherne2

1Department of General and Private Animal Science, Chuvash State Agrarian University, 29 Karl Marx Street, 428003, Cheboksary, Russian Federation
2Department of Feeding, LLC ‘Natural Products of Povolzhie’, 8 Tekstilshchikov Street, 428037, Cheboksary, Russian Federation

*E-mail: lavrentiev_au@edu.academy21.ru https://orcid.org/0000-0001-5793-8786

Abstract. Sow milk is usually enough to meet the need for nutrients of three weeks age piglets. However from the beginning of life they need supplemental nutrients in the form of creep feeding. The objective of this study was to survey the usefulness of special mixed feeds (super starter, pre-starter, starter feeds) given as creep feeding and feeding to suckling pigs, as well as the use of immunostimulant for their health, better growth and development. The study showed that suckling pig fed with special super starter, pre-starter and starter mixed feed depending on age, as well as young animals additionally treated with intramuscular injected immunostimulant better by growth rate. The highest indicators for the live weight of piglets at the age of 60 days (weaning) and for the milk content of sows were in the experimental group, which was intramuscularly injected with an immunostimulator The highest live weight of (weaning) piglets aged 60 days was in treated groups.

1. Introduction
Growing suckling pigs is a responsible and rather challenging task, since even with successful farrowing, a high percentage of young animals may die or contract a disease. The primary concern in the feed management strategy for suckling pigs is to early introduce feed and creep feed to them, as well as to prevent diarrhea and anemia. Therefore, it is crucial to ensure proper care and feeding to the piglets. These will help to improve the health of the pig crop and enhance their survival, which will further be beneficial for the health and performance of pigs [1-3].

Regardless of the adopted technology of pork production, the system of animal rearing is one of the most important technological processes, on the results of which the final zootechnical and economic indicators of the entire industry depend [4-5].

In newborn piglets, the main organs and systems of the body continue to develop. The digestive system is underdeveloped, the immune system is developing gradually, a piglet is rapidly gaining weight. For good development, it is important to ensure that the pig crop has proper husbandry, which includes a variety of different factors. One week old piglets need 30-36 degrees ambient temperature; for that reason, a special infrared lamp or a regular 150 watt electric bulb is hanged in the cage. To prevent overlying of pigs or injuring newborn piglets, barriers made of metal pipes or wooden poles are installed along the walls, with distance from the wall 15-20 cm and height above floor level 20-25 cm. Once piglets grow a little and get stronger, the barrier is removed [6].

Pig feeding until they reach 2 months of age is the most demanding period in a piglet’s life. During the first 10-15 days of a piglet’s life, natural forage for piglets is sow’s milk [7].
Sow’s milk is usually enough to meet the need for nutrients of piglets up to 3 weeks of age, however from the beginning of life they need supplemental nutrients in the form of creep feeding. They are a super starter and prestarter, which play a crucial role in setting up the entire feeding system. And as is known, the earlier piglets switch to dry food, the better they will be prepared for weaning. Their digestive system develops faster, they gain larger live weight by 2 months of age [8].

As an energy source, prestarters include different types of grain crops, including some of which must be heat-treated. Besides that you can also use the waste of the confectionery and bakery industry, in small quantities – lactose or sugar [9].

Separately, it is necessary to note the role of extruded barley. This culture is rich in fiber that is useful for digestion. Due to the extrusion process, the structure of the fiber fractions is disrupted (or "explodes"). It increases the ability of the feed to absorb liquid, which additionally positively affects the solubility of the feed mass in the stomach and prevents its stratification [10].

Super starter and prestarter should quickly dissolve in the stomach juice of the animal, so that all its particles are well soaked in acid (ideally, the pH is 2-4). It stimulates the digestion process and reduces the development of pathogenic bacteria that enter the stomach with food. Of great importance is the viscosity of the feed, which can be increased due to the inclusion of components with a high concentration of non-starchy polysaccharides, and the extrusion of its individual components. Besides that the super starter and prestarter should contain components of animal origin with high biological value, since the digestive system of piglets in the first days of life is configured to consume milk and dairy products. Therefore, manufacturers often introduces powdered milk or whey powder into the composition of the first mixed feed [11].

Super starters and premium prestarters may include dry colostrum preparations. As a component of pre-starter feed, colostrum has a positive effect on the development of the intestinal tract, supports the immune system and has antibacterial and probiotic effects [12].

The found in egg yolk powder has effects like Colostrum on the immune system of young animals. The egg powder is also rich in immunoglobulins, which positively affect the development of the intestines of piglets.

Blood plasma is the next, rather expensive, but highly valuable protein component. It is a powder that is up to 92% protein, which is absorbed by animals by 93%. Blood plasma contains 15-20% of immunoglobulins and albumins. The using of this component in prestarters makes it possible to significantly improve the consumption of animal feed. Also, high protein absorption is characteristic of blood cells (aerosol drying) and protein hydrolysate (obtained from the tissues of the small intestine of slaughtered pigs). These products also serve a high consumption of mixed feed and obtain high weight gain. All the components are quite expensive, their share in prestarters is 1-3% (up to 5) [13].

Flax products, such as flax seeds, linseed oilcake or flax meal, have a positive effect on the intestinal tract of piglets and, thus, on their immune system. This is because flax is able to form mucus and contains unsaturated omega-3 fatty acids (alpha-linolenic acid). Special polysaccharides from flax swell in the intestine, which creates a large volume of mucus, stimulates the passage of passages, mucus binds toxic substances and quickly removes them from the body.

Increasingly, amaranth is being used as a part of prestarters. It is characterized by a high protein and fat content, contains an unusually high amount of lysine, and has a wide range of unsaturated fatty acids, including alpha-linolenic acid [14]. Potato protein is often used as a source of protein in imported prestarters. It contains about 74% crude protein with an attractive set of amino acids (high lysine content) and high digestibility. Soy protein concentrates are an effective substitute for animal proteins. They are purified from the anti-nutritional substances inherent in unprocessed soy, and contain up to 65% of raw protein [15].

The using of acids in pig feeding has been proven in practice. The inorganic acids only affect the change in the acidity index. Reducing the pH in the stomach prevents the ingestion of undigested protein in the distant parts of the intestine. Besides that the organic acids can pass through the cell membranes of microorganisms and affect the metabolism in them. Thus, the organic acids also have an antibacterial effect. In addition to synthetic amino acids, vitamins, minerals and trace elements that are part of each
prestarter, there are a number of feed additives that support the work of the intestine in different ways [16].

These are various enzyme (enzyme) complexes. So, the animal itself cannot synthesize such enzymes as xylanase and gluconase. The introduction of enzyme complexes that break down non-starch polysaccharides makes it possible to achieve this for such feed components as wheat and other grains, soy meal. Probiotics are biologically active feed additives that take on the function of "place holders" and target the colonization of the intestine with potentially harmful bacteria. Prebiotics also effectively support gut health. These prebiotic oligosaccharides can block the receptors of various potentially harmful bacteria in the gut. Aromatic additives and growth promoters are an important group of feed additives. These flavorings, acidifiers of taste are based on spices such as oregano, cinnamon, thyme, garlic and anise. Growth stimulators are a separate topic, regarding them it should be noted that the effect of their introduction into the feed can only be determined at a specific enterprise, and an unbalanced recipe cannot be corrected by using such a "miracle" supplement [17].

The last group of special additives, around which there is a wide discussion today, are free medium chain fatty acids with a chain length of 6 to 12 carbohydrate atoms or glycerol nests created from them, mostly in the form of tri-, di- and monoglycerides. They inhibit the growth of Gram-negative and Gram-positive bacteria (for example, Clostridium, streptococi). These fatty acids penetrate into the slightly acidic environment of the cell and, by interfering with the metabolism of the cell, inhibit the growth of these bacteria and destroy them.

The objective of this study is to establish the effect of special compound feeds and an immunostimulator on the growth, development and safety of suckling piglets.

2. Methods and materials

Experimental studies were conducted on suckling piglets of a large white breed aged from birth to 60 days of age, the dynamics of their growth and development. In accordance with the scheme of scientific and economic experience according to Ovsyannikov method [18], taking into account gender, age, breed, origin and live weight, three groups of sows with suckling pigs were formed on the principle of groups of analogues of 6 heads each (table 1). The zoohygienic parameters of the indoor microclimate were maintained. Pigs of all groups were in the same conditions of feeding and keeping, the optimal ambient air temperature in the room was 22...24˚C, the air humidity was not higher than 70-75% and they were fed compound feed in accordance with the developed recipes [19].

The drug PS-1 was used as an immunostimulant. The drug PS-1 was developed by the staff of the Chuvash State Agrarian University. It was a 0.5% aqueous suspension of a polysaccharide complex of yeast cells immobilized in agar gel with the addition of a biologically active substance - polyvinylpyrrolidone. The drug was approved by the Ministry of Agriculture of the Russian Federation (protocol No. 4 from 03 October 2000).

Suckling pigs were fed a super starter, a pre starter and a starter MIP LLC ‘ACADEMY-BIO’, Russia. The effectiveness of special compound feeds and the combined use of an immunostimulator and special compound feeds were taken into account according to the following indicators: the dynamics of the live weight of suckling piglets-by individual weighing on a scales ST-TCS-150 (Romitech, China), multiplicity of sows, nest weight at birth, milk content, the weight of one piglet during weaning and the safety of piglets.

Suckling pigs in the control group were fed pre-starter mixed feed available on the farm, starting from the 7th day of age. Pigs in treated groups were fed mixed feed from the same manufacturer: super starter – at the age of 3-14 days, pre-starter – at the age of 15-40 days, starter – at the age of 41-60 days. Pigs in treated group 2 also had immunostimulant injected intramuscularly: 0.3 ml – at birth, 0.5 – at the age of 10 days, 0.7 – at the age of 21 days, 1 – at the age of 45 days, 1.5 ml – at the age of 60 days, per head. In all groups, piglets were weaned from sows at 2 months of age.

The experimental design is given in the table 1. In the group 2 immunostimulant was fed as follows: at birth – 0.3 ml/head, at the age of: 10 days – 0.5 ml/head, 21 day – 0.7 ml/head, 45 days – 1 ml/head, and at 60 days – 1.5 ml/head.
The diet of suckling sows in the control and treated groups included wheat, barley and 20% protein vitamin-mineral concentrate. 1 kg of mixed feed contains 11 MJ of metabolic energy, 42% crude protein, 5.5% crude fiber, 3.3% lysine, 0.6% methionine, 5.1% calcium, 1.7% phosphorus, and 3% of NaCl.

| Groups         | Number of sows, heads | Creep feeding and feeding background for suckling piglets |
|----------------|------------------------|----------------------------------------------------------|
| Control group  |                        | 3-14 days pre-starter 15-40 days super starter pre-starter starter |
| Treated group 1| 6                      | 3-14 days super starter 15-40 days pre-starter starter |
| Treated group 2|                        | 3-14 days super starter 15-40 days pre-starter starter |

3. Results and discussion

Piglets need supplementary feed as early as from day 5-7 of their life. However, they cannot be fed ‘adult’ food: the stomach of an infant animal is unable to digest rough food. Special mixed feed of smooth texture and precise ratio of carbohydrates, proteins and vitamins is produced for them. As the piglet grows, the feed changes since food composition shall be different for certain ages.

Even if the sow’s milk can cover the needs of the piglets, they still need supporting creep feeding and feeding, since this allows animals to get used to feed rougher than milk.

The research showed that super starter, pre-starter, starter mixed feed and immunostimulant had positive impact on various livestock parameters for suckling piglets, fed both separately and together with immunostimulant.

Prolificacy of test sows was good and ranged between 10.17 and 11.83 heads, depending on the group (table 2). The first 21 days of pig life are the most challenging, therefore, due to various diseases and reasons, including due to overlying of pigs, an average of 8 pigs per group per 1 sow in the control group, and 4 heads in treated groups 1 and 2, respectively. Survival rate of pigs at this age was 86.94% in the control group, while in treated group 1 it was 6.97% higher than in control group, and in treated group 2 it was 7.3% more than in control group and 0.33 % higher than in treated group 1.

By the end of the sucking period, the number of dead pigs across the groups was 10 heads in control group, 7 heads in treated group 1 and only 5 heads in treated group 2. By the end of the experiment, the highest survival rate was in treated group 2 – 92.96%, which is 9.5% higher than in control group and 3.5% higher than in treated group 1. The reason for the death of suckling piglets was the squeezing of sows.

At the beginning of the experiment, live weight of newborn piglets ranged between 1.02 and 1.26 kg. At the age of 21 days, the live weight of test pigs had slight difference. The highest live weight of 5.83 kg was in the control group, which is due to the smallest number of heads per 1 sow vs. treated groups, since during this period these suckling pigs had more nutrients from the sow’s milk. As at the weaning, pig live weight in treated group 2 was much greater than in control group. The largest live weight of pigs at the age of 60 days (weaning) was in treated group 2 – 17.68 kg, which is 1.2 kg or 7.28% higher than in control group and 0.63 kg or 3.7% higher than in treated group 1, respectively.

Milk production of sows in treated group 2 was 59.0 kg, which is 11.1 kg or 23.2% more than in control group, and 2.75 kg or 4.9% more than in treated group 1. The difference for this parameter between test piglets in control and treated group 1 was 8.35 kg or 17.4% in favor of treated group 1.
Table 2. Research deliverables.

| Parameter                          | Control | Treated group 1 | Treated group 2 |
|------------------------------------|---------|-----------------|-----------------|
| Number of piglets per 1 sow, heads |         |                 |                 |
| at birth                           | 10.17   | 11.17           | 11.83           |
| as of day 21                        | 8.83    | 10.50           | 11.17           |
| at weaning                         | 8.50    | 10.00           | 11.00           |
| Died, heads                        |         |                 |                 |
| before day 21                       | 8.00    | 4.00            | 4.00            |
| between day 21 and day 60          | 2.00    | 3.00            | 1.00            |
| Survival rate, %                   |         |                 |                 |
| as at day 21                        | 86.94   | 93.91           | 94.24           |
| at weaning                         | 83.42   | 89.49           | 92.96           |
| Litter weight, kg                  |         |                 |                 |
| at birth                           | 10.35   | 12.95           | 14.75           |
| as at day 21                        | 47.90   | 56.25           | 59.00           |
| at weaning                         | 140.10  | 170.57          | 194.38          |
| Pig live weight, kg                |         |                 |                 |
| at birth                           | 1.02    | 1.16            | 1.26            |
| as at day 21                        | 5.43    | 5.36            | 5.38            |
| at weaning                         | 16.48   | 17.05           | 17.68           |
| Average daily bodyweight gain, g   |         |                 |                 |
| before day 21                       | 210.00  | 200.00          | 196.00          |
| between day 21 and weaning         | 283.00  | 300.00          | 315.00          |
| for the entire growing period      | 258.00  | 265.00          | 274.00          |

The largest litter weight at weaning of piglets was in treated group 2, which is 54.88 kg or 38.7% (P <0.01) more than in control group and 23.81 kg or by 13.9% more than in treated group 1. Litter weight in treated group 1 was 30.47 kg or 21.7% higher than in control group for this parameter. The highest average daily bodyweight gain of pigs up to 21 days of age was in control group – 210 g. This is due to the fact that this group had the lowest number of littermate pigs vs. treated groups, they had more milk from sows. Therefore, their average daily bodyweight gain was 10 grams or 5% higher than in treated group 1 and 14 grams or 7.1% higher than in treated group 2. During the entire experiment, pigs in treated group 2 showed the highest average daily bodyweight gain – 274 grams, which is 9 grams or 3.5% (P <0.05) higher than in treated group 1 and 16 grams or 6.2% (P <0.01) higher than in control group. The difference between the groups for all parameters was significant. The difference in average daily growth was significant between the control and treated groups.

The issues of the most effective use of compound feeds, increasing the biological value of diets, rational use of biologically active substances are priority areas of research on the intensification of pig breeding. When selecting feeds for composing diets in order to increase their productive effect, the use of biologically active substances that are part of superstarter, prestarter, starter compound feed, including an immunostimulator, is of great importance. The use of the above-mentioned compound feeds and an immunostimulator contributed to an increase in live weight, safety, milk production of sows and a decrease in mortality.

Currently, more than a hundred different feed additives and preparations containing proteins, amino acids, vitamins, macro- and microelements, antibiotics and other biologically active substances are used in animal feeding. Increasing the volume of livestock products and the efficiency of this industry as a whole requires strengthening the feed base, organizing scientifically-based full-fledged feeding of animals, improving various technological processes of production. When selecting feeds for the preparation of diets in order to increase their productive effect, the use of biologically active substances
is of great importance. Currently, science has developed technologies for the effective use of feed preparations in animal feeding, with the help of which it is possible to significantly improve the digestibility and digestibility of feed nutrients and increase productivity.

In the conducted scientific and economic experience, the influence of special compound feeds and an immunostimulator on the growth, development and safety of suckling piglets was established. The obtained information on the productivity of young pigs indicate the beneficial effect of special compound feeds and an immunostimulator on the growth of the live weight of suckling piglets.

4. Conclusion
In pork production technology, in order to improve the meat qualities of young pigs and more fully realize the genetic potential of productivity, it is advisable to use special superstarter, prestarter and starter compound feeds in feeding, depending on age. During the experiment, it was revealed that suckling piglets, which were injected intramuscularly with an immunostimulator, had a higher growth rate. We recommend using special compound feeds in conjunction with the injection of an immunostimulator in the production of pork.

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