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To cite this article: A A Reznichenko 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **315** 022037

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The use of prebiotics in broiler poultry as an alternative to antibacterial drugs

A A Reznichenko

Federal State Budgetary Educational Institution of Higher Education “Belgorod State Agricultural University named after V.Y. Gorin”, 1, Vavilova St., Mayskiy settlement, Belgorod district, Belgorod region, 308503, Russia

E-mail: reznichenko6531@gmail.com

Abstract. Breeding animals without the use of antibacterial drugs is a relevant branch of modern science, because the entry of national agricultural products into the foreign market provides for the antibacterial drugs absence in raw materials of animal origin. Therefore, in order to improve livability and productivity of animals, it is necessary to constantly monitor the resistance of their bodies, use antibacterial drugs more carefully and eliminate unnecessary or ineffective drugs completely. Thus, an important task facing the veterinary service of the Russian Federation is the complete elimination or reduction of the antibiotics use in animal breeding and the use of drugs that can replace antibacterial ones. We first studied the effect of heteropolysaccharides “raspol” and “gemiv” on broiler bodies. It is established that the used drugs allow eliminating the antibacterial drugs from the broiler ration. In the period of antibacterial drugs exclusion from the broiler preventive treatment scheme these prebiotics cause an increase in poultry gain, increase its livability and natural resistance, while the use of antibiotics in broiler control group negatively affects the body. Recommendations for the use of prebiotics raspol and gemiv in broilers, as an alternative to antibacterial drugs, are provided.

1. Applicability

The resistance of many microorganisms to antibiotics is a well-known problem in animal breeding. At the same time, the need to combat enteropathogens without the use of antibiotics is the main task of all developing countries. This problem is dictated by the fact that resistance to antibacterial drugs leads to difficulty, and in some cases the impossibility of treating a whole range of infectious diseases in humans and animals.

It is proven that antibiotic-resistant microorganisms can be passed from an animal to a human. Antibiotics used for therapeutic purposes and stimulation of growth and development of animals are accumulated in a significant quantity in food products - meat, milk, eggs. Free concentration of antibiotics for a short period of time is excreted from the body of an animal with waste products - feces, urine, the produced products (milk, eggs), but the one bound with protein or other components remains in the body for a long time. Antibiotics excreted from the body get into the soil in the form of organic fertilizers and then are accumulated in potatoes, vegetables and other crop-growing food products. Excessive or improper use of antibiotics in animal breeding inevitably leads to their accumulation in basic food products in a hyperadmissible quantity, posing a threat to human health, causing dysbacteriosis, allergy, reducing immunity [5].



Thus, breeding animals without use of antibiotics is a relevant branch of modern science, the entry of national agricultural products into the foreign market provides for the antibiotics absence in raw materials of animal origin [4], [9].

In Europe this issue is being successfully solved. But under our conditions, when a huge population of farm animals (poultry) is concentrated in national holdings, it is very difficult to stop using them.

Therefore, an important challenge the veterinary service faces is the use of drugs, being alternative to antibacterial drugs.

Currently this is an area of research and various alternatives: organic acids [2], phytobiotics [1], probiotics [8], immunomodulators [10].

The use of organic acids as a strategic alternative to the enteropathogen control is supported in most current studies. However, there is a limit on common use of organic acids, since enzyme systems functioning in the gastrointestinal tract of an animal metabolize these organic acids and make them useless.

Theoretically organic acids can be protected by means of encapsulation, but technology and materials do not yet meet commercial demand.

Phytobiotics - complexes of plant origin, first of all essential-oil crops. The phytoncidal substances contained in them kill germs. Phytobiotics have the most important property: microflora develops resistance to them, and therefore they are harmless to humans [6].

Probiotics are effective only in the small intestine, the acidity of which is favourable for the reproduction of lactic acid microorganisms. However, salmonella, as a rule, does not form colonies in this digestive area. The neutral environment of the caecum is more suitable for the growth of salmonella. [3].

Therefore, to combat salmonella, it is necessary to use prebiotics because they quite successfully exist in the caecum and produce organic acids themselves, which makes it possible to change pH of the intestine and destroy pathogens.

Prebiotics are chemical compounds that are not processed and not absorbed in the small intestine but are selectively fermented in the large intestine. They are the key to the flashy growth of certain beneficial microorganisms, in particular, bifidobacteria and lactobacilli [7].

Thus, if we want to achieve the predominance of beneficial microflora over pathogenic, we need to add products that promote the development of lactic acid bacteria.

The nutrition of the saprophytic microflora of the intestine and its proper functioning are crucially dependent on the delivery of polysaccharides to it, which under the action of the intestinal microflora are exposed to fermentation to form short-chain fatty acids (propionic, butyric, acetic), which in turn have a significant anti-inflammatory and anticarcinogenic effect.

It has been proven that lowering the pH level in the intestine due to bacteria keeping the level of lactic acid reduces the amount of enteropathogens. Low pH and healthy villi structure significantly improves calcium absorption (from 47% to 55%). It brings about improvement in quality of the eggshell in poultry and the strengthening of the skeleton in young birds.

Our solutions are aimed at replacing antibacterial drugs in the rations of farm animals with different ones that are harmless to the human body.

The test purpose: To study the effect of prebiotics “gemiv” and “raspol” on the body of broiler in order to offer these drugs as an alternative to antibacterial ones in poultry rations.

2. Material and method of analysis

The formation of groups was carried out according to the principle of analogues.

At the same time, the possibility of using prebiotics “gemiv” and “raspol” as an alternative to antibacterial drugs was studied.

Gemiv is a polysaccharide of microbial origin, is an analogue of guar gum. The main active ingredients are galactomannan and fatty acids. Raspol is a polysaccharide of plant origin.

The digital data received during all tests were statistically processed on a personal computer according to standard methods of variation statistics with the calculation of the Student function argument (td). The difference between the compared values was considered reliable at $p \leq 0,05$.

3. Test results and discussion

For carrying out the test according to the principle of analogues 6 groups of Arbor Acres cross broilers were formed, 60 birds each. The first group is a control one, the second, third, fourth, fifth and sixth groups are test ones.

Broilers from the control, the third and the fifth test groups received a ration according to the scheme adopted in the farm with the use of all antibacterial drugs (starting from 2 days old age, cipromag at the rate of 5 ml per 10 l was added into the water for 5 days, and this preparation was used with water for 5 days starting from the age of 20 days).

Antibacterial drugs were not used in broilers of the second, fourth and sixth test groups.

Gemiv at the rate of 0.4 g/kg of body weight was added to water for 10 days in broilers of the 5th and 6th test groups, starting from 7 days old age. Raspol at a dose of 0.5 g/kg of body weight was added into the water in broilers of the 3d and 4th test groups during the same period.

The test scheme is presented in the table 1.

Table 1. Scheme of tests on broilers.

Groups	Bird qty	Drugs used	Dose
1 – control	30	Basic diet (BD)	-
2 – test	30	BD (without antibacterial drugs)	-
3 – test	30	BD + raspol	0,6 g/1 kg
4 – test	30	BD (without antibacterial drugs) + raspol	0,6 g/1 kg
5 – test	30	BD + gemiv	0,4 g/1 kg
6 – test	30	BD (without antibacterial drugs) + gemiv	0,4 g/1 kg

As a result of the tests conducted, an increase in the average daily bird weight gain in all test groups was discovered (table 2).

Table 2. Results of prebiotic tests on broilers.

Indicators	Groups					
	1-control BD	2-test BD without antibiotic	3-test BD + raspol	4-test BD without antibiotic+ raspol	5-test BD + gemiv	6-test BD witho ut antibi otic+ gemiv
Quantity, birds at the beginning of the test	30	30	30	30	30	30
at the end of the test	28	26	30	30	29	29
Livability, %	93,3	86,6	100,0	100,0	96,6	96 ,6

Average daily weight gain, g	60,7	57,4	63,9	63,0	63,3	62,8
+/- towards control, %	-	-5,4	+5,3	+3,8	+4,3	+3,5

It should be pointed out that the highest bird livability was found in the third and fourth test groups (100%) where raspol was used, and in the fifth and sixth test groups, where gemiv was added into the water.

In these very groups there was the highest daily weight gain: 3.8-5.3% higher than in the control group after applying raspol and gemiv when completely eliminating antibiotics, and 5.3% and 4.3% higher - after the use of the same drugs, but antibiotics were used in the basic diet.

As for the second test group, the complete elimination of antibiotics in the diet led to a decrease in average daily bird weight gain (5.4% lower than the control indicators). In the same group, there was the lowest livability (86.6%).

When studying natural resistance, an increase in the blood serum bactericidal activity and the phagocytic activity of pseudo eosinophils as a result of all the studied drugs use was discovered (table 3).

Table 3. Indicators of natural resistance in broilers, n=20 (M±m).

Groups	Indicators		
	Bactericidal activity, %	Phagocytic activity, %	Lysozyme activity, %
At the beginning of the test period			
1 – control	32,29±1,54	38,20±1,46	10,52±1,46
2-test	32,41±1,84	37,85±1,53	10,43±1,70
3-test	31,67±1,69	39,27±1,68	10,13±1,83
4-test	31,48±1,80	37,41±1,46	10,77±10,41
5-test	32,33±1,72	38,77±1,601	10,51±1,80
6-test	31,47±1,73	37,8±1,77	10,67±1,52
At the end of the test period			
1 – control	32,65±1,88	37,21±1,59	11,89±1,14
BD			
2-test	30,27±1,53	35,79±1,67	10,91±1,28
BD without antibiotic			
3-test	40,14±1,77*	44,76±1,80*	12,13±1,76
BD + raspol			
4-test	39,24±1,80*	43,67±1,50*	13,28±0,55
BD without antibiotic+ raspol			

5-test			
BD + gemiv	39,03±1,90*	44,82±1,64*	12,87±1, 24
6-test			
OP without antibiotic + gemiv	39,12±1,89*	43,90±1,72*	13,25±1,39

*p<0,05;

So, after applying raspol in the 3rd test group, a reliable 22.9 and 20.3% increase in the blood serum bactericidal activity and phagocytic activity of pseudoeosinophils was recorded, respectively, in comparison with the control group. In the 4th test group, after using this drug, but completely eliminating antibiotics, the natural resistance indicators also gained 20.2 and 17.4%.

After feeding gemiv in the 5th test group, a 19.5 and 20.5% increase in the blood serum bactericidal activity and phagocytic activity of the pseudoeosinophils was recorded, respectively, compared with the control group. In the 6th test group, after using this drug, but completely eliminating antibiotics, the natural resistance indicators also gained 19.8% and 17.9%, respectively, in all cases the difference with the control group was confirmed statistically ($p < 0.05$).

4. Conclusion

Thus, the studies conducted have shown that raspol and gemiv increase body natural resistance and, as a result, increase the average daily weight gain and livability of broilers. Moreover, the complete elimination of antibacterial drugs from the bird diet does not have a negative effect on the body.

5. Practical proposals

Prebiotics gemiv and raspol are offered as an alternative to antibacterial drugs. Preparations are recommended to use in broilers adding to water at the rate of 0.4-0.5 g/kg of body weight during 10 days beginning from the age of 7 days.

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