Environment evaluation of usage of biosynthetic polymers in the diet of chicks of the Omsky Bely Cross

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Abstract. The article provides environmental evaluation of usage of feed additives including the mixture of sodium caseinate and polyvinyl alcohol and the mixture of gelatin and polyvinyl alcohol in the diet of chicks of the Omsky Bely cross at the starter period of development, and their influence on the hematological values, the productive qualities, and the condition of chickens. The research was carried out at the premises of the Bishkulskaya Poultry Farm Ltd. in the North Kazakhstan Province (the Republic of Kazakhstan); scientific and economic experiments were carried out with the Omsky Bely cross chicks. During the experiment, it was found out that this feed additive influenced on the survival of chicks, improved their biochemical values, which in turn improved the productivity, viability, and breeding value of poultry.
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Introduction

One of the most important problems of poultry breeding is to ensure high profitability of the production and to achieve environmental safety of products. Contaminated fodders and feed additives when penetrating into the poultry organisms along with compound feed are the cause of chronic poisoning. It results in slowdown of growth and development of growing poultry and decrease of fodder consumption. Usage of the mixture of sodium caseinate and polyvinyl alcohol in the diet improves the biochemical values of the chicks' blood, which in turn improves the productivity, viability, and breeding value of poultry.

Therefore, the intention of researchers to study the influence of the most efficient additives, which stimulate growth and development of organisms activating its protective and adaptive reactions and improving the poultry productivity and the quality of products, is rather clear [1].

Over the last decade, close attention has been paid to the quality of agricultural products. Contamination of fodders and feed mixtures with mushrooms producing micotoxins, salts of heavy metals, pesticides, radionuclides, and other toxic substances causes severe economic damage to poultry breeding. Penetrating into poultry organisms along with compound feed, they cause chronic poisoning. It results in slowdown of growth and development of growing poultry and decrease of fodder consumption [2].

Currently, much attention is paid to the quality of protein depending on the amino-acid structure and conformance of the quality of certain amino acids in the diet to the requirement of the organism [3].

In this view, an important line of the research of poultry foddering is the search of cheaper, non-traditional, and affordable feeds, which would be close to the traditional ones by their biological value [4, 5, 6, 7].

Unfortunately, our country very poorly uses such reserves of protein as skin wastes and byproducts of gelatin production [8, 9, 10, 11].

There is little information on the influence of the feed additive consisting of the mixture of biological and synthetic polymers on the productivity and physiological condition of poultry and the quality of products.

Materials and methods

The objective of the research is environmental evaluation of usage of feed additives including the mixture of sodium caseinate and polyvinyl alcohol and the mixture of gelatin and polyvinyl alcohol in the diet of chicks of the Omsky Bely cross at the starter period of development, and their influence on the hematological values, the productive qualities, and the condition of chickens.

The research was carried out at the premises of the Bishkulskaya Poultry Farm Ltd. in the North Kazakhstan Province (the Republic of Kazakhstan); the objects of the scientific and economic experiments held in 2005-2008 were the Omsky Bely cross chicks (Table 1).

Chicks were held in cage batteries and grown up until the age of 35 days. Housing conditions: light, temperature, and humidity regime, rate of stocking, watering, foddering were the same for all variants and

complied with the Guidelines for breeding the Omsky Bely cross poultry of the Western Siberia Zonate Experimental Poultry Station selection [12].

The research object was chicks of the Omsky Bely cross. Experimental variants were formed according to the principle of analogs (breed, age, development, live weight) at the age of one day in compliance with the guidelines of VNITIP (1992).

Experiments were carried out according to generally accepted standard guidelines. In the first and second scientific and economic experiments, chicks were grown until they reached the age of 35 days. During the experiments, one-day-old chicks were randomly allotted by four variants, 3,300 heads in each group. The first variant was the control variant, the second, third, and fourth ones were experimental.

The Omsky Bely cross was created based on the Bely Leggorn breed. The pedigree breeding of the egg breed chickens was carried out by the Siberian Research Institute of Poultry Breeding [13]. The cross was specially selected for the climatic zone of West and East Siberia and North Kazakhstan.

Table 1. The scheme of experiments

Variants	Number of heads	Diet contents
First experiment		
1 – control variant	3,300	Main diet (MD)
2 – experimental variant	3,300	MD + sodium caseinate with PVA in the proportion 1:2 (0.007%:0.013%)
3 – experimental variant	3,300	MD + sodium caseinate with PVA in the proportion 2:1 (0.013%: 0.007%)
4 – experimental variant	3,300	MD + sodium caseinate with PVA in the proportion 1:1 (0.01%:0.01%)
Second experiment		
1 – control variant	3,300	Main diet (MD)
2 – experimental variant	3,300	MD + gelatin with PVA in the proportion 1:2 (0.007%:0.013%)
3 – experimental variant	3,300	MD + gelatin with PVA in the proportion 2:1 (0.013%:0.007%)
4 – experimental variant	3,300	MD + gelatin with PVA in the proportion 1:1 (0.01%:0.01%)

The advantage of this poultry cross resides in the fact that during several generations, it was being selected in the circumstances of the current technology of Siberia using fodders produced from local raw materials [14]. The most important features of the Omsky Bely cross are high reproducibility, high rate of eggs conception and hatchability of chicks, ability to feather out rapidly, early maturation, medium egg production capacity with optimal weight of eggs, excellent conversion, and almost absolute absence of the brooding instinct. The protein of the eggs of the Bely Leggorn breed is the master sample for protein of other products by the amino-acid content. The eggs have virtually no meat or blood inclusions, and are the best ones by taste [12].

Sodium caseinate and gelatin were used as the biological polymers.

Various preparations of sodium caseinate are produced [15]. Currently, taking into account the achievements of the Russian science, P.F. Dyachenko, N.K. Rostros, A.V. Pavlov in cooperation with the Siberian branch of VNIMI implemented the new Technical Order TU 9229-077-00419785-97 «Edible sodium caseinate" instead of TU 49 721-85. We used sodium caseinate produced in compliance with the requirements of TU 49721-85 [15, 16].

We used edible gelatin with 15% humidity, 2% zonality, and molecular weight equal to 70,000. Gosagroprom's enterprises produce edible gelatin in compliance with the State Standard GOST 11293-78 [17, 18].

Polyvinyl alcohol was used as the synthetic polymer. We used the laboriously purified low-molecular polyvinyl alcohol with the following characteristics: molecular weight – 100,000; humidity – 10%; ash content – 0.01% [19, 20].

For the purposes of the experiment, they brought one-day-old poultry of the same age in consignments to the breeding shop of the Bishkulskaya Poultry Farm Ltd. One consignment of poultry filled up a whole rearing house. In this farm, they breed chicks in cage batteries. At that, they pay due attention to creating optimal environmental conditions of the microclimate in the rearing houses: the light, temperature, and humidity regimes.

Between 1st and 35th days of poultry growing, the light regime was being reduced from 24 to 15 hours according to the following scheme: During the first and second weeks, the daylight duration was equal to 24 hours, during the third week – 22 hours, during the fourth week – up to 20 hours, and during the fifth week – up to 15 hours. It is a known fact that gentle reduction of the daylight contributes to good growth and further better productivity. The test showed that such daylight regime positively influenced on the survival of chicks during the starter period and helped saving main fodder.

Abidance by the recommended abiotic parameters of the rearing house contributed to favorable development of chicks. Scientific research and practice have proven that fast changes of temperature in rearing houses result in waste of fodder and reduce its accessibility [21].

During the period of the experiment, each variant was provided with the diet common for the poultry farm. The premix used at the Bishkulskaya Poultry Farm Ltd. along with vitamins, macro and microelements contains the substitute of whole milk, which is as close as possible to the natural whole milk by feeding value, digestibility, and biological value and is suitable for substituting whole milk in poultry diet [22]. The main deficiency of the whole milk substitute is its poor suitability for manufacturing,

caking ability, early adulteration, low content of protein; it cannot be stored and fed in zinc-plated utensils as junction of milk acid and zinc causes severe diseases and deaths of poultry [23].

In order to eliminate the above deficiencies of the used feed additives, the whole milk substitute in the premix was replaced with environmentally safe feed additives in the diet: the mixture of sodium caseinate with polyvinyl alcohol, the mixture of gelatin with polyvinyl alcohol (in the quantity of 0.02% (7 mg) of the live production weight of one chick) in different proportions. The mixtures were preliminarily dissolved in water and then added to the feed mixture.

Application of additives to the mixture of sodium caseinate and polyvinyl alcohol was estimated by the following criteria: change of the live weight of chicks over time, gain in the live weight by certain periods of breeding, the average daily gain of chicks by periods of age, the relative rate of growth of chicks (Table 2).

The table makes it clear that different additives of sodium caseinate and polyvinyl alcohol differently influence on the end weight of chicks.

For example, chicks in the second group had the greatest live weight. Chicks in the third and fourth groups showed lower live weight.

Table 2. Change of the live weight of chicks over time, g

Age, days	Variants			
	1	2	3	4
	control group	sodium caseinate and PVA (1:2)	sodium caseinate and PVA (2:1)	sodium caseinate and PVA (1:1)
0	35.10±0.04	35.05±0.03	35.00±0.03	35.02±0.03
7	55.30±0.05	67.21±0.04	59.37±0.04	64.47±0.04
14	91.00±0.15	150.46±0.09	129.67±0.10	143.77±0.09
21	145.70±0.09	204.96±0.06	178.9±0.07	195.97±0.07
28	220.75±0.14	358.76±0.09	324.0±0.09	345.14±0.09
35	302.50±0.07	396.76±0.05	364.00±0.056	377.80±0.05

For example, chicks in the second group had the greatest live weight. Chicks in the third and fourth groups showed lower live weight. The difference between the second and the first (the control) variants equaled to 11.91 grams (21.5%) at the age of 7 days. At the age of 35 days, the difference reached 94.26 grams (31.2%).

During the whole starter period, considerable valid difference between the chicks by weight was observed, which was accompanied with control measurement of all tested variants ($t_{actual} > t_{theor.}$) at the 1% level of the Student test significance. But these differences turned out to be insignificant between the experiment variants.

During the experiment, it was found out that this feed additive also influences on the chicks survival. It increased by 7.34% (variant 2), 6.2% (variant 3), and 6.55% (variant 4) in the experimental variants as compared to the control variant.

The results of study of the feed additive (the mixture of sodium caseinate and polyvinyl alcohol) on the hematological values of the chicks' blood are provided in Table 3.

As the table shows, the number of erythrocytes, thrombocytes, general protein, hemoglobin, as well as concentration of sugar and content of calcium in the experimental variants was higher than in the control variant and remained within the physiological limits. And if we compare the variants 2, 3, and 4, their content is larger in the second variant, in which chicks were given the feed additive containing the mixture of sodium caseinate and polyvinyl alcohol in the 1:2 proportion.

Having analyzed the obtained data, we can see that the content of basophiles, eosinophils, bilirubin, and fibrinogen in all four variants was the same. The comparative data show that the number of erythrocytes in the second experimental variant is greater by 1.9% than in the fourth variant and by 2.7% than in the third one. The content of hemoglobin with the chicks of the second variant is larger than in the fourth variant by 4.1% and larger than in the third variant by 7%.

Table 3. Main hematological values of chicks' blood

Indexes	Variants			
Sodium caseinate and PVA	1	2	3	4
	control group	sodium caseinate and PVA (1:2)	sodium caseinate and PVA (2:1)	sodium caseinate and PVA (1:1)
Erythrocytes, mil/sq. mm	3.71±0.01	3.86±0.01	3.76±0.01	3.79±0.01
Leukocytes, thousand/sq. mm	26.26+0.01	26.28+0.01	26.27+0.01	26.27+0.01
Thrombocyte, thousand/sq. mm	76.25±0.01	76.48±0.01	76.38±0.01	76.44±0.01
Sugar, mg/ml	66.2±0.02	71.9±0.02	70.9±0.02	71.5±0.02
Total protein, g/l	8.16±0.02	8.95±0.02	8.7±0.02	8.85±0.02
Hemoglobin, mg/100 ml	8.61±0.03	9.85±0.03	9.25±0.03	9.5±0.03
Basophiles, %	2.16	2.16	2.16	2.16
Eosinophils, %	6.04	6.04	6.04	6.04
Bilirubin, µmol/l	3.03	3.03	3.03	3.03
Calcium, mg/100 ml	13.80±0.07	18.85±0.06	18.10±0.07	18.5±0.06
Fibrinogen in plasma, %	0.38	0.38	0.38	0.38

We can notice the high saturation of the erythrocytes of the second variant chicks with hemoglobin unlike in the case of other experimental variants.

The number of thrombocytes in the second experimental variant is greater than in the fourth (0.05%) and third (0.13%) variants. The content of calcium in the blood of chicks in the second experimental variant is by 36.6% greater than in the control variant, and in the third and fourth variants is by 31.2% and 43% greater accordingly.

The chicks in the experimental variant had yellow nibs, good floccus, and good reaction to external irritants.

Calculation of the prime cost and profitability shows that this feed additive is economically beneficial for the farm. For example, the profit per one kilogram of live weight in the case of using the

mixture of sodium caseinate and polyvinyl alcohol is 189.34 rubles on the average, and the level of profitability is equal to 144.91%.

Thus, usage of the mixture of sodium caseinate and polyvinyl alcohol in the diet improves the biochemical values of the chicks' blood, which in turn improves the productivity, viability, and breeding value of poultry.

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References

1. Smolyakov, A.V., 2003. Prospects of Usage of the Milk-Acid Additive in Poultry Breeding. In the Proceedings of the III International Scientific and Practical Conference, Novosibirsk, pp: 143-151.
2. Prosviryakova, O., M. Polyansky and V. Menshchikov, 2006. The "Sorbent-Stimulator" Feed Additive. Ptitsevodstvo, 1: 8-9.
3. Maltsev, A.B., N.A. Maltseva, I.P. Spiridonov and V.M. Davydov, 2005. Non-Conventional Fodders and Feed Additives. Omsk: regional typography, pp: 704.
4. Fonseca, N., N. Aparecida, I. Mixubuti, J. Pinheiro, C. Khatounian, A. Laffanchi, R. Sato, A. Ostrenky and G. Daniclides, 1995. Ficito do uso feijao guandu eru moido (Cajanos cajan (L.) Milisp) sobre o desepenho de poedciras comerenis. Semina, Vol.16, 1: 115-121.
5. Tangaweewipat, S. and R. Elliot, 1989. Nutritional value of pigeonpea (Cajanus cajan) meal in poultry diets. Anim. Feed Sc.Technol., 25: 1-2.
6. Richter, G., H. Richter and H. Bents, 1989. Einsatz von methanol bakterienmasse in muitigenerationsversuch am mitt legeperiode. Arch. Tierernahr, Vol.39, 12: 131-139.
7. Maltseva, N.A., 2000. Application of Sapropels at Foddering Broiler Chickens. Abstract from Thesis of Candidate of Agricultural Science, State Scientific Institution "Siberian Research institute of Agricultural Products Processing", pp: 24.
8. Aewsiri, T., S. Benjakul, W. Visessanguan, P.A. Wierenga and H. Gruppen, 2010. Antioxidative activity and emulsifying properties of cuttlefish skin gelatin–tannic acid complex as influenced by types of interaction. Innovative Food Science & Emerging Technologies, Vol.11, 4: 712-720.
9. Quintana, D., P. Domingues and S. García, 2008. Effect of two artificial wet diets agglutinated with gelatin on feed and growth performance of common octopus. Aquaculture, Vol. 28 1–4: 161-164.
10. Reibe, C., Ž. Knez and E. Weidner. A new high-pressure micronisation process for the gentle processing of high molecular mass gelati. Food and Bioproducts Processing. Vol.90, 2: 79-86.
11. Sinthusamran, S., S. Benjakul and H. Kishimura. Characteristics and gel properties of gelatin from skin of seabass (*Lates calcarifer*) as influenced by extraction conditions. Food Chemistry, 152: 276-284.
12. Balakina, L.A., A.V. Davydov, A.V. Egorkin, V.G. Krytsyn, A.B. Maltsev et al, 1997. Guidelines for Growing the Omsky Bely Cross Poultry. Omsk-Morozovka, pp: 34.
13. Davydov, V.M., 2002. Improvement of Efficiency of Egg and Meat of Poultry of High Productivity Crosses. Abstract from Thesis of PhD of Agriculture, Russia`s scientifically-researching and technological institute of Poultry farming, Sergiev Posad, pp: 38.
14. Davydov, V.M., A.B. Haze, A.B. Maltsev and I.P. Spiridonov, 2004. In the Collection of Scientific Works dedicated to 100th Anniversary of F.M. Kotomsky: Rational Usage of Feed Resources and Genetic Potential of Livestock. / Omsk state agricultural institute of veterinary. Omsk: , pp: 58-67.
15. Gronostayskaya, N.A., T.I. Mineeva and S.P. Petrova, 1999. Creation of Milk and Protein Concentrated Feedstuff. Molochnaya Promyshlennost, 12: 33-34.
16. Guo, M., P.F. Fox, A. Flynn and K.S. Mahammad, 1989. Heat-induced changes in sodium caseinate. J. Dairyres, Vol.56, 3: 503-512.
17. Triers, I.V., R.A. Dolmatova, Z.V. Khokhlova and S.L. Kobyakova, 1990. Technological and Bacteriological Control in the Clue T38 and Gelatin Industry: Reference Book. Moscow: Agropromizdat, pp: 303.
18. Dik, E. and E.V. Ovsyannikova, 2006. Gelatin: Properties, Singularities, Function. Edible Ingredients. Raw Materials and Additives, 2: 52-57.
19. Usmanov, Kh.U. and M.A. Askarova, 1984. Chemistry and Physical Chemistry of Natural and Synthetic Polymers. Tashkent: Nauka. UzSSR, pp: 136.
20. Beckturov, E.A., 1981. Synthetic and Water Soluble Polymers in Solutions. Almaty: Nauka, pp: 248.
21. Jaffar, G.H., J. Blaha and T.V. Phung, 1996. Effects of high ambient temperature on growth rate, feed consumption and feed efficiency of broilers feed high energy and protein diets. Zivoc. Vyroba, Vol. 41, 4: 163-169.
22. Spiridonov, I.P., A.B. Maltsev and V.M. Davydov, 2002. Feeding Agricultural Poultry: from A to Z. Omsk: Regional Printing House, pp: 697.
23. Zholbosynova, A.S., M.A. Kineev, N.S. Salykova and E.E. Mautov, 2005. Application of the Mixture of Sodium Caseinate and Polyvinyl Alcohol in Chicks' Diets. Herald of the Kazakhstan Agricultural Science Bastau, 8: 74.

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