Possible effects of functional feed additive as a growth promoter in turkeys and pigs

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Abstract. Effects of functional feed additives based on the fungus *Fusarium.S* and organic acids were studied. The research studied corporal parameters, the safety, growth and development of young turkeys and pigs. It was found that the Asido Bio-TCIT feed additive improves the physiological state of piglets and turkey poults, reduces feed conversion, increases live weight and profitability of meat production.

1 Introduction

The current task is the production of environmentally-safe food which provides the transition to bio-regulatory therapy, which is based on increasing the natural resistance of farm animals by exposing them to bio-products and natural metabolites, such as peptides, peptones, organic acids, oligo-polysaccharides, as well as probiotic preparations that suppress the activity of pathogenic and spoilage microorganisms. Probiotics have antioxidant activity and enhance intestinal barrier function, stimulate cellular immunity of intestinal mucosa and blood [1–4].

The prevention and treatment of intestinal infections in poultry and pig farms are also positively affected by feed acidifiers, which consist of a mixture of organic acids (acetic, formic, propionic, sorbic, etc.). Organic acids, entering the body, act mainly in the proximal part of the gastrointestinal tract (stomach and small intestine). Besides, decreasing gastric acidity increases protein transportability and therefore increases animal growth intensity [3–6].

As a result of innovative developments, a natural, environmentally friendly liquid feed additive Asido Bio-TCIT was obtained. It is a balanced synergistic combination of non-pathogenic vital products, genetically not modified microorganisms and the most important organic acids.

The use of Asido Bio-TCIT in various livestock and poultry farms increases digestibility, improves metabolism, reduces microbial contamination of water during feeding. The biological properties of Asido Bio-TCIT are associated with the presence of physiologically active substances, which include: essential polyenoic acids, including arachidonic and omega-3 acids, enzymes, including ribonucleases, proteases, collagenase, etc., polysaccharides (mannans, b-glucans), organic acids (citric, lactic, acetic), microelements (K, Mg, Fe, etc.), vitamins A, groups B, P, H; wide spectrum of amino acids, peptides and peptones.

The mechanism of action of Asido Bio-TCIT is to maintain the pH level along the entire length of the digestive tract due to the synergistic effect of organic acids, which functionally complete each other, leading to improved digestibility, strengthening the immune system of poultry and reducing the number of pathogenic bacteria in the digestive tract [5–8].

The morphological composition of blood is of great diagnostic value. Many factors affect the composition of the blood, including the general state and health of the turkey. Also, the morphological parameters of the blood allow them to be used to assess the state of metabolic processes in the body of turkeys [9–12].

2 Materials and methods

In order to study the influence of the Asido Bio-TCIT liquid feed acidifier produced by the Center of Innovative Technologies (the Republic of Belarus, V.V. Khorushkin) onto growing turkey poults of “BIG-6 “cross and piglets, experiments were conducted in "Zalesny" farm in the Zelenodolsk District of the Republic of Tatarstan and “Tukash" farm in the Tulachinsky district of the Republic of Tatarstan.

2.1 Experimental animals

28 Day-old female turkey poults (kartzfehn-Germany) “BIG-6“cross, total number 100, housed in closed housing under woody litter were raised (18-hour light/dark cycle, 50–70 % humidity at 23–26 °C temperature) at Zalesny farm in the Zelenodolsk District of the Republic of Tatarstan.

The turkeys were divided into two groups, 50 animals each. The first group was the control group, it`s ration did not include any additives and the second group was the experimental group, whose ration included Asido Bio-TCIT in a dose of 1.0 ml /animal/day in drinking water.

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76 piglets aged 21 days were selected for the experience and divided into 2 groups. Animals of the first, control group received the main ration without any additives, while, piglets of the second test group received the main ration with a functional feed additive.

All protocols for experiments with animals were carried out in full compliance with the guidelines for animal care and were approved by the Animal Care Committee from Kazan State Academy of Veterinary Medicine named after N.E. Bauman.

2.2 Blood and tissue sampling

Blood samples were collected from 20 female turkeys from each group in days 28 and 105 following admission (2 samples/female) from the axillary vein, one sample collected in a heparinized tube to avoid coagulation. For morphological analysis, blood was collected along the wall of the tubes. The second sample was collected in a test tube without anticoagulant for biochemical analysis. The blood samples were stored in ice tanks until transferred to the laboratory on same the day for further analysis.

2.3 Biochemical analysis

Biochemical blood test was carried out on Stat Fax 4200+ biochemistry analyzer. Ready-made reagent kits produced by Vital Diagnostik were used**.** At the end of the experiment, a controlled slaughter was carried out for 20 animals in each group for the anatomical examination of the internal organs and tissues.

3 Results

During the whole experiment, the physiological state of the experimental turkeys was assessed by the general appearance, behavior, feeding and drinking quantity, as well as by the results of biochemical blood tests.

It was noticed that during the period of the study, all experimental turkeys were clinically healthy, had good appetite for food, a good reaction to various external stimuli, there were no signs of any diseases or deficiency. The feces of turkeys of all groups had normal appearance, color and consistency and there were no signs of indigestion, which indicated normal functioning of the gastrointestinal tract.

Our studies have shown that the use of Asido Bio-TCIT in the diet of turkeys of experimental groups had a positive effect on the increase in live weight of birds (Table 1).

In the experimental group the safety of turkeys increased by 2 %, compared with the control group. In addition to, during the entire experimental period, turkey poults in the experimental group developed better than in the control group, and by the 105-day age the live weight reached 10377 kg, significantly exceeding the results of the control group (by 12 %).

The average daily gain in live weight of turkey poults in the experimental group was 125.16g, which is 13.11 % higher than in the control group. Wherever, the addition of Asido Bio-TCIT liquid to the ration allowed reducing the cost of feed per unit of production, compared with the control group by 16 % which can be assumed that due to increased petite, digestibility of feed.

Analysis of table 2 showed that the weight of gutted carcasses of turkeys of the experimental group is more than control group by 12.31 %. The weight of semi-gutted carcasses of turkeys of the control group, compared with the weight of semi-gutted carcasses from experimental group, is 12.33 % less.

When studying the morphometric parameters of the mass of carcasses and some internal organs revealed a significant increase in weightin turkeys of the experimental group (Table 3).

The results of our experiment showed that the females of the experimental group have the largest absolute weight of internal organs. The most intensively the weight of the liver and heart increased in turkeys of the experimental group to 124g or 14,8 % and 32,73 g or 17,9 % ($p < 0.05$).

Table 1. Productivity of turkey poults from day 1 to slaughtering.

Parameters	Control group	Experimental group
Number of heads at the beginning of experiment	50	50
Number of heads at the end of the experiment	48	49
Safety %	96%	98%
Live weight (g) at the age of: 28 105	 730±3,0 9250±93.4**	 740±2,6 10377±112.5**
% of control	100%	112%
Absolute increase in live weight, g	8520	9637
Average daily gains for the entire period of experience, g	110.65	125.16
% control	100%	113.11%
The relative increase in live weight, %	170.74	173.37
Feed consumption per 1 head total, kg	30.6	28.9
The cost of feed per 1 kg increase in live weight, kg	3.31	2.78

Significance. ($p < 0.05$) *, ($p < 0.01$) **

Table 2. Meat qualities of turkeys and the ratio of the various parts of the carcasses of experimental turkeys

Parameters	Control group	Experimental group
Pre-slaughter weight, g	9250±93.4	10377±112.5
Semi-gutted carcass weight, g	7952±83.3	8933±77.6**
% of pre-slaughter weight	85.97%	86.08%
Gutted carcass weight, g	7096±62.5	7970±71.2**
Slaughter yield, %	76.71%	76.80%
In that include: chest	2652±44.4	2982±45.7*
%	37,37%	37,40%
Back	1487±31.9	1666±36.1*
%	20.96%	20.9%
Thigh	1178±20.2	1322±26.7*
%	16.60%	16.59%
Leg	817±14.1	922±14.8
%	11.51%	11.57%
Wing	812±14.8	908±15.2
%	11.45%	11.39%
Neck	150±7.4	170±7.5
%	2.11%	2.13%

Macroscopic data showed that the morphology of the muscle tissue of white and red meat, as well as the internal organs (spleen, liver, kidney, ventricle, stomach, and heart) do not differ significantly without pathological changes or abnormalities.

Analysis of table 4 shows that at the end of the experiment there was a significant increase in the amount of hemoglobin and red blood cells in the experimental group of turkeys by 8,14, 8,29 %, respectively.

The results show that there is no significant difference between the two groups in the number of neutrophils, eosinophils, basophils, lymphocytes and monocytes.

Table 3. Mass of internal organs

Parameters	Control group	Experimental group
Pre-slaughter weight, g	9250±93.4	10377±112.5
% of pre-slaughter weight	100 %	100 %
Liver, g	108±2.1	124.02±2.5*
% of pre-slaughter weight	1.17 %	1.20 %
Spleen, g	4.63±0.2	5.41±0.2
% of pre-slaughter weight	0.05 %	0.05 %
Heart, g	27.75±0.8	32.73±0.9*
% of pre-slaughter weight	0.30 %	0.32 %

Table 4. The morphological composition of the blood of turkeys

Parameters	Age, day	Control	Experimental
Hemoglobin, mmol/l	28	132±2.67	134±2.54
	105	135±80	146±3.11**
Erythrocytes, 10 12/l	28	2,05±0.06	2,10±0.07
	105	2,17±0.05	2,35±0.12*
Leukocytes,1000 / mm^3	28	20,84±0.52	20,75±0.48
	105	22,40±0.60	21,73±0.55
ESR mm/h	28	2,26±0.37	2,19±0.35
	105	2,30±0.41	2,13±0.55
Banded neutrophils	28	1±0.4	2±0.6
	105	1±0.3	1±0.2
Segmented neutrophils	28	17±0.8	20±0.9
	105	25±1.0	27±0.9
Monocytes %	28	74±1.3	73±1.9
	105	72±1.5	76±1.9
Lymphocytes %	28	3±0.4	2±0.4
	105	2±0.4	2±0.5
Eosinophils %	28	132±2.67	134±2.54
	105	135±80	146±3.11**
Basophils %	28	2.05±0.06	2.10±0.07
	105	2.17±0.05	2.35±0.12*

Table 5. Biochemical parameters of blood serum.

Indicator	Age, Day	Control	Experimental
Total protein, g/l	28	49.3±0.16	49.4±0.09
	105	49.9±0.10	52.5±0.11**
Calcium, mmol/l	28	4.13±0.01	4.18±0.01
	105	4.19±0.01	4.36±0.01**
Phosphorus, mmol/l	28	2.18±0.01	2.24±0.01
	105	2.19±0.01	2.22±0.01
The ratio of Ca: P	28	1.89±0.01	1.91±0.01
	105	1.86±0.01	1.96±0.01
Reserve alkalinity mmol/l	28	50.11±0.06	50.28±0.08
	105	49.89±0.05	49.56±0.07

Analysis of table 5 showed that total protein in the experimental group increased by5,12 % compared with the control group. It is well known that blood proteins perform many important functions: balance blood pH, immunity, combined with carbohydrates, lipids, hormones and other substances, then the concentration of total protein in blood serum determines the efficiency of metabolism in turkeys.

Based on the analysis of previous studies, the authors together with the Center of Innovative Technologies and Biovector developed a new functional feed additive with the addition of a complex of biologically active substances.

It was noticed that the use of a functional feed supplement positively affected the physiological state, behavioral reactions, feeding capacity of the mixed feed and the safety of piglets.

In comparison with the control group, the live weight and average daily gains of the live weight of the pigs receiving feed additive by the end of experience increased respectively by 8.7 % and 14.3 % ($P < 0.05$) and reached 20.388 kg.

In the first control group, the feed cost per 1 animal was at the level of 2.13 kg, in the second experimental group – 1.77 kg. The economic effect per 1 ruble of additional costs/ animal was 2.57 rubles, and became – 3.9 rubles. Thus, the feed additive contributed to reduced feed conversion and increased profitability of pork production.

4 Conclusion

Based on the studies, it can be concluded that the use of functional feed additives in poultry and pig farming improves the physiological condition of farm animals and poultry, reduces feed conversion, increases live weight and production profitability.

References

1. E. Demir, S. Sarica, M.A. Ozcan, M. Suicmez, Archiv fur Geflugelkunde, **69**, 110–116 (2005)
2. G. Srinivas, V.C. Preetam, B. Swathi, Indian J. anim. sci., **4**, 461–463 (2017)
3. G. Suresh, R.K. Das, S. Kaur Brar, T. Rouissi, A. Avalos Ramirez, Y. Chorfi, S. Godbout, Crit. Rev. Microbiol., **44**, 318–335 (2018)
4. S.H. Khan, J. Iqbal, J. Appl, Anim. Res., **44**, 359–369 (2016)
5. O.A. Yakimov, M.K. Gainullina, D.V. Aksakov, RJPBCS., **1**, 1716–1724 (2019)
6. S.I. Al-Sultan, S.M. Abdel-Raheem, W.R. El-Ghareeb, M.H. Mohamed, Jpn. J. vet. res., **64**, 187–195 (2016)
7. M.W. Birmani, A. Nawab, M.W. Ghani, G. Li, J. Wu, W. Liu, Animal Review, **6**, 5–16 (2019)
8. S.R. Hashemi, H. Davoodi, J. anim. Vet. adv., **9**, 2295–2304 (2010)
9. M. Taklimi, H. Lotfollahian, A.Z. Shahne, F. Mirzaei, J. Agric. Sci., **3**, 5 (2012)
10. B. Dębski, J. Anim. Feed Sci., **10**, 169–180 (2018)
11. B. Owens, L. Tucker, M. Collins, K. McCracken, Brit. Poultry sci., **49**, 202–212 (2008)
12. M.A. Dawood, S. Koshio, M.Á. Esteban, Beneficial roles of feed additives as immunostimulants in aquaculture: a review, Rev. in Aquacult., **4**, 950–974 (2018)