Effect of Organic Acids Supplement on Performance of Broiler Chickens

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Abstract

This study was conducted in order to evaluate effect of organic acids on broiler performance. Totally 180 chickens of Ross 308 hybrid were divided to three groups. Experimental group no. 1 (n=60) received acetic acid in drinking water with concentration 0.25% from day 1 to day 42. Experimental group no. 2 (n=60) received citric acid in drinking water with concentration 0.25% from day 1 to day 42. Control group (n=60) received drinking water without any additives. The average body weight, feed consumption, mortality and carcass characteristics were analyzed and compared finally. The results showed no significant effects of diets with addition of organic acids ($P<0.05$) on body weight. Supplementation of citric acid caused decrease in total feed consumption. Addition of organic acids affected positive total mortality of broiler chickens. There were no significant effects of organic acids supplementation on carcass characteristics.

Keywords: chicken, acetic acid, citric acid, body weight, feed consumption, mortality, carcass characteristics

1. Introduction

The increased pressure on livestock industry to phase out the use of prophylactic dosages of antibacterial growth promoters (AGP) in the European Union due to microbial resistance in animals and human and the potential to do same in other parts of world has stimulated increased interest in alternative natural growth promoters [1].

Several alternatives to antibiotic growth promoters have been proposed such as for example organic acids [2], probiotics [3-5], phytogenic feed additives [6], products of bees [7] and enzymes [8].

The supplementation of organic acids in the diet of broilers enhanced nutrient utilization, growth, and feed efficiency [9].

The use of citric acid creates an acidic environment (pH 3.5 to 4.0) in the gut that favors the development of lactobacilli and inhibits the replication of *Escherichia coli*, *Salmonella*, and other gram-negative bacteria [10].

Several studies support the statement that the addition of citric acid to broiler rations improved weight gain [11], increased feed consumption [12] and improved feed efficiency [13].

It also decreased pH of cecal digesta, crop and gizzard [14] and intestine [9].

The study was conducted in order to evaluate acetic and citric acids on performance of broiler chickens.

2. Materials and methods

The experiment was realised in half-operation conditions of experimental basis of Department of Poultry Science and Small Animal Husbandry.

Totally 180 chickens of Ross 308 were divided to three groups. Experimental group no. 1 (n=60) received acetic acid in drinking water ad libitum with concentration 0.25% from day 1 to day 42. Experimental group no. 2 (n=60) received citric acid in drinking water ad libitum with

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concentration 0.25% from day 1 to day 42. Control group (n=60) received drinking water without any additives.

The feeding period lasted 42 days. Two types of complete feed mixtures (Boskop, a.s., Trenčín, Slovak Republic) have been distributed according to periods of fattening: HYD - 01 (day 1 - day 21) in powdery form and HYD - 02 (day 22 - day 42) in granular form, both no inclusions of anticoccidials. Nutritional value of diets is shown in Table 1. Feeding was provided on an ad libitum basis from containers on the front of the cages.

Birds were stabled in a 3-etage cage technology (MBD, Czech Republic) consisted of 18 cages with proportions 75x50 cm (0.375 m^2).

Electric light (neon bulbs) illuminated the trial house over 24 h.

During the 42 days experimental period the growth performance of broiler chickens was evaluated by recording body weight in weekly intervals, total feed consumption at the end of fattening period and total mortality.

At the end of the experiment, 10 broiler chickens of similar body weight to the group average were selected from each group, weighted and killed by severing of the bronchial vein. The weights of carcass, breast, thing and abdominal fat were recorded individually. The differences among group means were verified statistically by analysis of variance using Duncan's test.

Table 1. Nutritional value of complete feed mixtures

Nutritient	Unit	HYD - 01	HYD - 02
Crude protein	g/kg	min. 210	min. 190
ME	MJ/kg	min. 12	min. 12
Lysine	g/kg	min. 11	min. 9.5
Methionine and cistine	g/kg	min. 7.5	min. 7.5
– from that methionine	g/kg	min. 4.5	min. 4
Linoleic acid	g/kg	min. 10	min. 10
Calcium	g/kg	min. 8	min. 7
Phosphorus	g/kg	min. 6	min. 5
Sodium	g/kg	1.2 -3.0	1.2 -2.5
Manganese	mg/kg	min. 50	min. 50
Iron	mg/kg	min. 60	min. 60
Copper	mg/kg	min. 6	min. 6
Zinc	mg/kg	min. 50	min. 50
Vitamin A	i.u./kg	min. 10000	min. 8000
Vitamin B2	mg/kg	min. 4	min. 3
Vitamin B12	μg/kg	min. 20	min. 20
Vitamin D3	i.u./kg	min. 1200	min. 1200
Vitamin E	mg/kg	min. 15	min. 15

3. Results and discussion

The performance showed significant increase in average body weight ($P<0.05$) for citric acid when compared with the control in 21. and 28. day of fattening.

At the end of the fattening period, citric acid resulted in higher average body weight than acetic acid and control, but differences between groups were no statistically significant ($P>0.05$). These results are opposite to those of [10], who recorded statistically significant higher ($P<0.05$) body weight in chickens supplemented of citric acid on parameters in case of citric acid is in agreement with the results of [11, 13, 14], who reported that the end of fattening. We recorded lower average body weight for application of acetic acid in comparison with control (2600.00 vs. 2639.66 g). In contrast, [13] found that the addition of dietary acetic acid improved live body weigh of broiler chicks as compared with those fed unsupplemented diets. The effect of organic acids supplementation on average body weight of broiler chickens is shown in Table 2.

Totally feed consumption was different between groups (control 1.79 kg, acetic acid 1.80 kg and citric acid 1.77 kg). Lower value of this the addition of citric acid to a broiler diet improved feed efficiency.

The mortality of broiler chicken was positive affected by application of organic acids (in both groups without mortality), in case of control group we recorded mortality in rate 1.67%.

Table 2. Effect of organic acids on average body weight in broiler chickens

Day of fattening	Control	Acetic acid	Citric acid
1.	40.63±3.72	40.20±3.82	40.42±4.50
7.	106.27±13.54	103.87±15.02	103.02±14.51
14.	286.78±39.21	280.65±36.67	286.35±40.17
21.	686.15±86.82	682.03±84.58	730.13±93.86 [a,b]
28.	1302.20±152.54	1252.83±152.10	1328.33±160.98 [b]
35.	1890.68±224.57	1904.85±224.50	1972.83±240.83
42.	2639.66±310.97	2600.00±280.82	2721.33±318.68

a,b $P<0.05$; Values shown are mean ± SD (standard deviation)

As shown in Table 3, the slaughter weight of the broiler chickens in all groups was no significant affected by addition of organic acids ($P>0.05$). These results are no compatible with the results drawn from the study of [10, 15], who concluded that there is statistically significant influence of the supplementation of organic acids on slaughter weight.

There were no statistically significant differences ($P>0.05$) between groups on carcass yield of broiler chickens. Differences in breasts and thighs of chicken from control and experimental groups with addition of organic acids were not statistically significant ($P>0.05$). Also, [16] noted that carcass characteristics were not affected by supplementation of organic acids.

Table 3. Effect of organic acids on carcass characteristics of broiler chickens

Characteristic	Control	Acetic acid	Citric acid
Slaughter weight (g)	2628.39±61.67	2591.79±68,26	2714.08±70.72
Carcass yield (%)	77.51±1.54	77.40±1.72	77.98±1.99
Breast (%)	29.87±3.21	30.15±3.67	30.35±3.18
Thighs (%)	31.58±2.82	31.29±2.59	31.88±2.49
Abdominal fat (g)	39.46±4.17	40.02±5.82	40.73±5.18

Values shown are mean ± SD (standard deviation)

4. Conclusions

In conclusion, this study demonstrated that citric acid as a feed additive statistically no significant affected final body weight of broiler chickens. In contrast, the addition of acetic acid decreased final body weight compared with citric acid and control respectively. Also, supplementation of citric acid positive affected feed efficiency of broiler chickens. Mortality of chickens was positive affected by application of organic acids. In carcass characteristics, addition of organic acid in drinking water no affected carcass yield, percentage of breast and thighs and average weight of abdominal fat.

Acknowledgements

This work was financially supported by the Scientific Grant Agency of Ministry of Education, Science, Research and Sport of the Slovak Republic and the Slovak Academy of Science under the contract VEGA 1/0493/12.

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