Effects of humic acids on broiler performance and digestive tract traits

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This study was carried out to investigate the effect of humic acids (HA) supplementation provided through drinking water on performance, carcass and some gut traits of broilers. In a randomized design, 480 mixed-sexes Ross 308 broilers were allocated into four experimental groups consisted of four replicate (30 birds per replication). All birds were housed in pens over 42 day. All chickens were offered a commercial diet *ad libitum* in mash form. Treatments were: 1) 0 (H_0), 2) 1.7 (H_1), 3) 5.1 (H_2) and 4) 8.1 ppm (H_3) HA per kg live weight supplemented in drinking water. Feed intake and body weight were recorded at 21st and 42nd days of trial. Data were analyzed by one way ANOVA. Live weight gain was higher in H_1 group than control group both on 21-42 and 0-42 day periods ($P<0.05$). Feed consumption in the H_1 group was higher than that in H_3 group at 0–42 day period. Feed conversion ratio, carcass yield, heart, gizzard, edible viscera, abdominal fat pad and gut weight were not affected by HA supplementation ($P>0.05$). The H_2 treatment caused an increase in liver weight compared to control group. Gut length was higher in H_1 group than control group ($P<0.05$). These results show that 1.7 ppm HA supplementation increased live weight gain and feed consumption without affecting feed efficiency.
Keywords: Humic acids; poultry; performance, digestive tract

Introduction

After the application of antibiotics as feed additives in order to enhance growth in production animals has lately been restricted (Enberg et al. 2000), researchers have looked for new feed additives that are not harmful to human health. Humic acid based mixtures have the potential to be an alternative to antibiotic growth promoters in broiler diets (Ceylan et al., 2003). Humic acids (HA), a class of compounds resulting from decomposition of organic matter, are natural constituents of drinking water, soil and lignite (EMEA, 1999; Anonymous, 2002; Shermer et al., 1998). Although the idea of using humates as feed additives in animal nutrition is new and especially humates were used as a part of replacement therapy for digestive system disturbances such as malnutrition and diarrhea (EMEA, 1999) and also to improve feed conversion ratio in calves (Kuhnert et al., 1989; 1991), broiler (Karaoglu et al 2004; Ceylan et al., 2003), turkey (Parks et al., 1996) and pig (Kim et al., 2004), it was determined that humic acid preparations increase animal performance (Bailey et al., 1996; Ceylan et al., 2003; Yoruk et al., 2004; Yasar et al., 2002). High HA concentrations may cause pollution in drinking water (Rath et al., 2006), but there were not any reports related to the effect of HA that was added in water on broiler performance. Therefore, this study was conducted to determine the effects of HA addition in drinking water on broiler chicken performance.

Materials and methods

In the trial, 480 mixed-sex Ross 308 broilers were used and fed on commercial diets for 42 days. The treatment groups were 0(H_0), 1.7 (H_1), 5.1 (H_2) or 8.1 (H_3) ppm HA per kg of live weight. Feed and water were offered *ad libitum.* The HA was given daily via drinking water. Diets (Table 1) were obtained from a commercial feed production company in Samsun. The feeding program consisted of a

starter diet fed to the chicks from 1 to 21 d of age, followed by a grower diet fed from 21 to 35 d of age, and a finisher diet fed from 35 to 42 d of age. Humic acids contained 10% dry matter (DM), 0.3% humic acid (HA), 0.025% fulvic acid (FA), 0.122% Ca, 0.006% Mg, 0.0037% K, 0.0232% N, 0.033% S, 1.57 ppm P, 6.5 ppm NO^-_3, 47.74 ppm Fe, 1.25 ppm Zn, 0.25 ppm Ni, 0.03 ppm Pb, 0.4 ppm Cr, 0.16 ppm Sn, and 1.1 ppm Cu. Humic and Fulvic acid contents of humic acids were determined in UV spectrophotometer; all minerals of humic acids were determined by atomic absorption spectrophotometer. All birds were housed in pens with four replicates. Feed intake and body weight gain were recorded at 21st and 42nd days of trial. At the end of the experiment, 64 broilers (16 broilers; 8 male and 8 female per group) were slaughtered.

Data were subjected to analysis of variance using one way ANOVA procedure of the statistical system at SPSS (release 10.5). Differences between means were ranked by Duncan's multiple range test of significance level of 5%.

Table 1. Ingredient and chemical composition of the experimental diets (kg/ton)

Ingredients	Starter period	Grower period	Finisher period
Corn	408.65	330.16	416.00
Soybean meal (44%)	290.30	276.88	250.20
Sun flower meal	77.02	--	--
Cracked wheat	100.00	65.05	125.22
Wheat bran	--	200.00	100.00
Meat and bone meal	63.93	64.23	51.90
Vegetable oil	52.00	56.23	50.00
Salt	2.30	1.00	2.40
Mineral-premix	2.5	2.5	2.5
Vitamin-premix	1	1	--
Lysine	1.20	1.20	0.08
Methionine	1.10	1.75	1.70
Calculated content			
DM (%)	89.0	88.7	88.9
ME (kcal/kg DM)	3100	3200	3200
CP (%)	23.0	21.0	19.0
Ca (%)	1.02	1.00	0.80
P (%)	0.50	0.50	0.42

1) Each kg vitamin premix contain; 6.000.000 IU Vitamin A, 1.200.000 IU Vitamin D3, 15.000 mg Vitamin E, 2.000 mg Vitamin K3, 1.500 mg Vitamin B1, 3.500 mg Vitamin B2, 12.500 mg Niasin, 5.000 mg Calcium D pantotenat, 2.500 mg Vitamin B6, 7.5 mg Vitamin B13, 500 mg Folic acid, 22.5 mg D- Biotin, 62.500 mg Colin clorit, 25.000 mg Vitamin C, 750 mg Canthaxanthin, 250 mg Apo carotenoic acid,
2) Each kg mineral premix contain; 30.000 mg Fe, 40.000 mg Mn,. 30.000 mg Zn, 2.500 mg Cu, 100 mg Co, 500 mg I, 75 mg Se.

Results and discussion

The effects of humic acids on performances of broilers are presented in Table 2. Live weight gain was higher in H_1 group than that in control group both on 21-42 and 0-42 day periods ($P<0.05$). Feed consumption in the H_1 group was higher than that in H_3 on 0–42 day period. Feed conversion ratio, carcass yield, heart weight, gizzard weight, abdominal fat pad and gut length were not affected by HA supplementation ($P>0.05$). Liver and gut weights increased in H_2 group than that of control group. These results showed that supplementation level of 1.7 ppm HA in water pan increased live weight gain. Ceylan et al. (2003) and Bailey et al. (1996) reported that supplementation level of 0.25% humate (Biomoss, a different product of humic acids) enhanced BWG of broilers and these results supported results of our study. But Kocabaglı et al. (2002); Karaoglu et al. (2004) and Yalcin et al. (2005) have reported that 0.1-0.25% humate additions did not affect BWG of broilers. On the contrary, supplementation of 0.5-2.5% HA in ration decreased BWG of broilers (Rath et al., 2006). Differences in BWG between our study and other studies might be attributed to the fact that HA sources and levels were different.

Table 2. Effect of humic acids on broiler performance and digestive tract traits.

	Treatments				
Days	H_0	H_1	H_2	H_3	SEM
Body weight					
1	40.95	40.92	40.95	40.84	0.03
21	643.99	642.05	653.68	635.33	4.82
42	1927.39a	2074.93b	1982.89ab	1943.68ab	23.71
Body weight gain					
0–21	603.04	601.15	612.73	594.49	4.80
21–42	1283.4a	1432.88b	1329.21ab	1308.35ab	23.40
0–42	1886.44a	2034.01b	1941.94ab	1902.84ab	23.71
Feed consumption					
0–21	958.74	950.62	957.55	933.83	9.35
21–42	2738.75	2862.88	2812.70	2669.42	36.53
0–42	3697.49ab	3813.50b	3770.25ab	3603.25a	34.62
Feed conversion ratio					
0–21	1.59	1.58	1.56	1.57	0.02
21–42	2.13	1.99	2.12	2.04	0.03
0–42	1.96	1.87	1.94	1.89	0.02
Relative organ weights* (%)					
Edible viscera weight	4.33	4.15	4.42	4.45	0.06
Gut length	11.07	11.15	11.48	11.79	0.14
Gut weight	8.52a	8.67ab	9.10b	9.07ab	0.10
Abdominal fat	1.33	1.22	1.28	1.36	0.04

* Calculated as percentage of live weight.
Means in a column with different letters are significantly different (P<0.05).

It has been shown that using high HA concentration in drinking water decreased feed consumption. It was reported that HA supplementation in ration decreased feed consumption of broilers and hens (Rath et al., 2006). On the contrary, Ceylan et al., (2003) have reported that HA supplementation in ration did not affect feed consumption of broilers and hens. Differences in feed consumption may have resulted from the differences in amount of HA added to water. Also, Yasar et al., (2002) have reported that HA supplementation in drinking water of rats did not affect feed consumption.

In conclusion, HA was found to enhance live weight gain at the level of 1.7 ppm without any negative effects on feed conversion ratio and some digestive tract traits.

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