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Effects of Humic Acid at Different Levels on Growth Performance, Carcass Yields and Some Biochemical Parameters of Quails

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Abstract: The current trial was carried out to determine the effects of humic acid at different levels on body weight gain, feed consumption, feed efficiency, carcass yield, heart weight and some biochemical parameters of quails. A total of 260 Japanese quails, seven day old were randomly assigned to one control and three experimental groups. The experimental period lasted five weeks. The quails were fed with a basal diet or the basal diet supplemented with 360, 480 and 600 mg kg^{-1} humic acid . Body weight gain, feed conversion ratio were positively influenced ($p<0.01$) by humic acid (480 mg kg^{-1}) supplementation at the growing period. Difference among the groups in terms of carcass yields, heart weight and biochemical parameters such as phosphorus, potassium, iron, copper, zinc, total protein, glucose, cholesterol, triglyceride, VLDL were not statistically significant. Calcium levels were significantly increased in the experimental groups compared with the control group ($p<0.05$). As a result; dietary humic acid supplementation during growing period at dose rate of 480 mg kg^{-1} feed can be used to improve body weight gainand feed efficiency.

Key words: Humic acid, performance, carcass, biochemical parameters, quail

INTRODUCTION

Antimicrobial feed additives are worldwide used so far in animal husbandry to improve the economy and ecology of animal production by increasing growth rate, decreasing feed expenditure per gain and diminishing the risk of disease (Gropp *et al*., 1992). In addition to feedstuffs, some microbiological cultures and various chemical agents such as probiotics, prebiotics, antibiotics, humates and enzymes, etc. have been added to animal diets as feed additive to enhance nutrient utilization, improve feed conversion ratio and maintain health status. But during the past several years, inclusion of probiotics and humates in rations is preferable to antibiotics, primarily because they cause no harmful effects on consumers (Eylan *et al*., 2003; Yoruk *et al*., 2004; karaoglu *et al*., 2004; kucukersan *et al*., 2005). Humic substances are the most ubiquitous carbon substance on the surface of the earth, found in almost every drop of water and in almost all soils. Humic substances are the most widely distributed organic products of biosynthesis on the face of the earth (Tan, 2003). Exceeding the amount of carbon contained in all living organisms by approximately one order of magnitude (Steven, 1994; Steinberg, 2003). They stimulate growth by improving the uptake of micronutrients (Chen *et al*., 1999; Chen *et al*., 2003).

The objective of the present study was to investigate the effect of supplementation of humic acid at different levels on performance, slaughter, carcass characteristics and some biochemical parameters of quails.

MATERIALS AND METHODS

In this research, a total of 260 Japanese quails (*Coturnix coturnix japonica*) at one weeks of age were used. The birds were randomly assigned to one control and three experimental groups based on their initial body weight, comprising five replicates of 13 birds each. They were fed a basal diet (H0) or the basal diet supplemented with either 360 (H1), 480 (H2) or 600 (H3) mg kg^{-1}of humic acid. Ingredients and chemical compositions of the basal diets are shown in Table 1. Chemical compositions of the diets were analyzed using the international procedures of (AOAC, 1994). Small amounts of the basal diet were first mixed with the respective amount of humic acid as a small batch and then with a larger amount of the basal diet until the total amounts of the respective diets were homogeneously mixed.

The diets and water were given for ad libitum consumption throughout the experiment lasting five weeks. The birdhouse was lit 24 h 1day.

Body weights and feed consumption data were recorded at weekly intervals. Body weight gain and feed conversion ratio were also calculated.

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Table 1: Ingredients and chemical analyses of diets fed to quails (g kg^{-1})

Ingredients	H0	H1	H2	H3
Maize	554.50	553.55	552.00	550.95
Soybean meal	364.00	363.00	363.50	364.00
Fish meal	51.00	51.00	51.00	51.00
Vegetable oil	11.00	11.00	11.00	11.00
Dicalcium phosphate	3.50	3.50	3.50	3.50
Calcium carbonate	11.00	10.70	11.00	10.80
Salt	2.50	2.50	2.50	2.50
Vitamin mineral premix[a]	2.50	2.50	2.50	2.50
Humic acid (16 %)		2.25	3.00	3.75
Total	1000	1000	1000	1000
Chemical analysis,drymatter (DM) basis				
Crude protein (g kg^{-1})	241	240	240	241
Calcium (g kg^{-1})	8.1	8.0	8.1	8.1
Total phosphorus (g kg^{-1})	7.2	7.1	7.2	7.1
Calculated values				
ME (MJ kg^{-1})	12.129	12.121	12.129	12.155
Lysine (g kg^{-1})	13.8	13.8	13.8	13.8
Methionine+cystine (g kg^{-1})	8.0	8.0	8.0	8.0

[a]Vitamin premix provided the following per kg diet: Vitamin A, 12500 IU; Vitamin D3, 1500 IU; Vitamin E, 31.25 mg; Vitamin K3, 3.75 mg; Vitamin B1, 2.5 mg; Vitamin B2, 7.5 mg; Niacin 25 mg; Cal. D-pantothenate 10 mg; Vitamin B6, 5mg; Vitamin B12, 0.019 mg; Folic acid 1 mg; Choline chloride 250 mg; Mn 100 mg; Fe 75 mg; Zn 75 mg; Cu 6.25 mg; Co 0.25 mg; I, 1.25 mg;Se 0.19mg.

At the end of the trial, the birds were held for 4-6 h without food and water prior to the determining of final body weights. Each bird was weighed live and slaughtered. The heart was dissected from the viscera, cut open and rinsed of its content. The carcass was immersed in water 4°C and washed. Upon removal from water, the carcass was drained for 10 min, weighed for hot carcass weight and yield, bagged and stored at 3±0.5°C for 24 h (Yalcin *et al*., 1999). Upon removal from the bag, carcass was weighed to determine a cold carcass weight and yield. Carcass procedures mentioned above was performed by two experienced people according to (Brake *et al*., 1993).

At the end of five weeks, ten animals of each group were decapitated and blood samples were collected into heparinized tubes. Plasma fasting blood calcium, phosphorus, potassium, iron, total protein, glucose, cholesterol, triglyceride, VLDL concentrations were measured by automated chemistry analyser (Aeroset, Abbott, USA) using commercial kits (Abbott). Copper and zinc concentrations were determined by a Spectra AA 250 plus Zeeman Atomic Absorption Spectrometer (Varian, Australia) with a deuterium background correction.

Data were statistically analyzed by a one-way ANOVAand the means were compared by the Duncan's multiple-range test (Steel and Torrie, 1981).

RESULTS AND DISCUSSION

The average body weight, daily body weight gain, daily feed consumption and feed conversion values of treatment groups are shown in Table 2. It is apparent that the difference between control (H0) and treatment groups in terms of body weight (H1, H2 and H3) was not significant at the 1, 2, 3, 4, 5 and 6 weeks of the research. Feeding humate during the growing period had the most beneficial effect on quail performance in terms of body weight gain. The feed conversion rate in H2 group was higher than that of H3 group at the end of experimental period. The feed conversion rate of H2 group was slightly better than those of the other groups (Table 2). These results were similar to the results obtained from studies carried out on this subjec (Ceylanet *et al*., 2003; Eren *et al*., 2000; Kocabagli *et al*., 2002). Kocabagli *et al*. (2002) compared the effects of dietary humate supplementation at 2.5 g kg^{-1} on broiler performance from 0 to 42 d. Body weights at 21 d were not affected by the dietary regimens. At 42 d, body weights and feed conversions of broilers were significantly affected by the dietary humate treatments. At the end of experimental period, feeding humate during the grower period had the most beneficial effect on broiler performance in terms of growth and feed conversion. This may be explained by humic acid stabilises the intestinal microflora and thus ensures an improved utilisation of nutrients in animal feed (Shermer *et al*., 1998). This leads to an increase in the live weight of quails. (Yasar *et al*., 2002), concluded that humic acid caused weight gain increase in rats. The improved weight gain was associated with increased ileal epithelial mass, increased feed intake, improved feed conversion ratio and increased nitrogen retention in rats.

Feed consumption values were measured as 16.17, 16.14, 16.10 and 16.11 g for the H0, H1, H2, H3 treatment groups, respectively (Table 2). At the end of the experiment, no statistically significant difference in feed consumption between the groups was observed. The lowest feed consumption was obtained in H3 group until 3rd week.

The results on the slaughter, carcass and heart weights values are shown in Table 3. As shown in the table, the differences between groups in terms of all slaughter and carcass characteristics were not significant. The findings on carcass yields values were in agreement with results reported by Eren *et al.* (2000) and Kocabagli *et al.* (2002).

Biochemical parameters such as phosphorus, potassium, iron, copper, zinc, total protein, glucose, cholesterol, triglyceride and VLDL of Japanese quails were not affected by the dietary humic acid. The values of blood parameters investigated in this study

Table 2: Effects of humic acid on performance in japanese quails

		H0	H1	H2	H3	
Parameters	Week	Mean±SEM	Mean±SEM	Mean±SEM	Mean±SEM	P
	1	22.75±0.06	22.49±0.18	22.80±0.35	22.55±0.31	ns
	2	54.18±0.51	52.83±0.72	53.85±0.95	51.60±0.95	ns
BW(g)	3	91.84±1.45	91.15±1.14	89.86±2.83	88.03±2.34	ns
	4	126.66±1.16	124.16±1.93	122.33±2.06	125.02±2.13	ns
	5	154.99±1.57	155.10±1.87	154.47±2.75	152.19±2.06	ns
	6	173.16±1.75	173.23±1.86	174.69±2.93	171.72±1.53	ns
	2-3	4.90±0.03^{a}	4.85±0.03^{ab}	4.75±0.03^{bc}	4.67±0.01^{c}	**
BWG (g day^{-1})	4-6	3.88±0.02^{b}	3.95±0.03^{ab}	4.03±0.02^{a}	3.98±0.02^{a}	**
	2-6	4.29±0.04	4.31±0.03	4.32±0.05	4.26±0.03	ns
	2-3	13.70±0.06^{a}	13.68±0.03^{a}	13.62±0.09^{ab}	13.43±0.06^{b}	*
FC (g day^{-1})	4-6	17.81±0.05	17.78±0.05	17.75±0.04	17.89±0.05	ns
	2-6	16.17±0.03	16.14±0.03	16.10±0.03	16.11±0.02	ns
	2-3	2.79±0.01^{b}	2.82±0.02^{ab}	2.86±0.01^{ab}	2.87±0.02^{a}	*
FCR (FI LWG^{-1})	4-6	4.59±0.01^{a}	4.50±0.03^{ab}	4.40±0.03^{b}	4.49±0.04^{ab}	**
	2-6	3.76±0.01^{ab}	3.74±0.01^{ab}	3.72±0.02^{b}	3.78±0.02^{a}	*

BW: Body Weight; BWG: Body Weight Gain; FC: Feed Consumption; FCR: Feed Conversion Ratio

Table 3: Effects of humic acid on carcass characteristics in japanese quails

	H0	H1	H2	H3	
Parameters	Mean±SEM	Mean±SEM	Mean±SEM	Mean±SEM	P
Live weight at slaughter (g)	158.40±1.97	158.20±2.13	157.78±2.10	157.55±2.37	ns
Chilled carcass weight (g)	120.20±1.47	117.80±2.27	119.60±2.56	118.00±2.42	ns
Chilled carcass yield (%)	75.91±0.60	74.43±0.76	74.64±0.60	73.84±0.46	ns
Hot carcass weight (g)	116.00±1.42	114.40±2.18	115.20±2.33	114.60±2.06	ns
Hot carcass yield (%)	73.26±0.70	72.29±0.74	71.90±0.57	71.74±0.51	ns
Heart weight (g)	1.69±0.06	1.63±0.03	1.78±0.04	1.82±0.06	ns
Heart yield (%)	1.06±0.03	1.05±0.01	1.11±0.04	1.14±0.03	ns

Table 4: Effects of humic acid on biochemical parameters in japanese quails

Parameters	H0	H1	H3	H4	P
Calcium (mg dL^{-1})	7.09±0.80^{b}	7.32±0.93^{b}	8.14±0.77^{b}	10.58±0.82^{a}	*
P (mg dL^{-1})	4.95±0.59	5.46±0.42	5.45±0.61	6.28±0.58	ns
K (mEq L^{-1})	1.96±0.20	2.01±0.17	2.14±0.22	2.26±0.16	ns
Fe (μg dL^{-1})	95.77±9.02	105.00±10.15	109.00±11.64	131.37±10.68	ns
Copper (μg dL^{-1})	22.39±1.96	24.66±1.72	20.25±1.29	19.21±1.60	ns
Zink (μg dL^{-1})	185.22±14.27	205.79±20.24	234.05±10.70	233.21±18.93	ns
Total protein (g dL^{-1})	1.88±0.22	1.98±0.11	1.83±0.23	1.76±0.14	ns
Glucose(mg dL^{-1})	251.00±21.72	271.70±21.27	277.30±22.67	304.50±26.09	ns
Cholesterol (mg dL^{-1})	110.77±13.29	140.12±15.10	123.10±14.80	127.80±7.32	ns
Triglyceride (mg dL^{-1})	50.42±5.06	55.88±8.81	55.83±12.70	51.87±9.65	ns
VLDL (mg dL^{-1})	10.00±1.09	11.44±1.95	11.00±2.54	10.25±1.96	ns

were supported by the other studies (Eren *et al*., 2000). But serumcalcium concentrations in the experimental groups were significantly increased ($p<0.05$) when compared with the control group HA is said to improve protein digestion as well as calcium and trace element utilization and an immunity rise by 5-7% (Ertas *et al*., 2006). High calcium concentration in the experimental groups can also be associated with early laying Ertas *et al*. (2006) (Table 4).

CONCLUSION

As a result, dietary humic acid supplementation during growing period at dose rate of 480 mg kg^{-1} feed can improve body weight gainand feed efficiency.

REFERENCES

AOAC., 1994. Official Methods of Analysis of the Association of Official Chemists. (14th Edn.), Inc. Arlington.

Brake, J., B. Havenstein, S.E. Scheideler, B.R. Ferket and D.V. Rives, 1993. Relatinship of sex, ageand body weight to broiler carcass yield and offal production. Poult. Sci., 72: 1137-1145.

Chen, Y., C.E. Clapp, H. Magen and V.W. Cline, 1999. Stimulation of Plant Growth by Humic Substances: Effects on Iron Availability. In: Ghabbour, E.A. and G. Davies (Eds.), Understanding Humic Substances Advanced Methods, Properties and Applications. Roy. Soc. Chem., Cambridge, UK., pp: 255-263.

Chen, Y., H. Magen and C.E., Clapp, 2001. Plant growth stimulation by humic substances and their complexes with Iron. Proceedings of the International Fertilizer Society Symposium, Lisbon, March 2001.

Ceylan, N., I. Ciftci and Z. Ilhan, 2003. The effects of some alternative feed additives for antibiotic growth promoters on the performance and gut microflora of broiler chicks. Turk. J. Vet. Anim. Sci., 27 : 727-733.

Gropp, J., D. Birzer and A. Schuhmacher, 1992. Vom Gesamtnutzen der Futterzusatz-stoffe; ein Beitrag zur Auflösung des Widerstreits von Ökonomie und Ökologie, Schriftenreihe der Akademie für Tiergesundheit, Bonn, Band 3. Verlag der Ferber'schen Universitätsbuchha-ndlung Gießen, pp: 168-204.

Eren, M., G. Deniz, S.S. Gezen and I. Turkmen, 2000. Effects of humates supplemented to the broiler feeds on fattening performance, serum mineral concentration and bone ash. Ankara Üniversitesi Veteriner Fakültesi Dergisi, 47: 255-263.

Ertas, O.N., M. Ciftci, T. Güler and B. Dalkilic, 2006. The Use of Possibility of Mussel Shell Supplementation as Calcium Source in Japanese Quails Raised Under Heat Stress Conditions. The Effect of Mussel Shell on Egg Yield and Some Blood Parameters F.Ű. Saölik Bil. Dergisi, 20: 15-20.

Karaoglu, M., M. Macit, N. Esenboga, H. Durdag, L. Turgut and O.C. Bilgin, 2004. Effect of supplemental humate at different levels on the growth performance slaughter and carcass traits of broilers. Int. J. Poult. Sci., 3: 406-410.

Kocabagli, N., M. Alp, N. Acar and R. Kahraman, 2002. The effects of dietary humate supplementation on broiler growth and carcass yield. Poult. Sci., 81: 227-230.

Kucukersan, S., K. Kucukersan, I. Colpan, E. Goncuoglu, Z. Reisli and D. Yesilbag, 2005. The effects of humic acid on egg production and egg traits of laying hen. Vet. Med. Czech., 50: 406-410.

Shermer, C.L., K.G. Maciorowski, C.A. Bailey, F.M. Byers and S.C. Ricke, 1998. Caecal metabolites and microbial populations in chickens consuming diets containing a mined humate compound. J. Sci. Food Agric., 77: 479-486.

Steel, R.G.D. and J.H. Torrie, 1981. Principles and procedures of statistics. (2nd Edn.), Mc Graw-Hill International Book Company, Tokyo.

Steinberg, C.E.W., 2003. Ecology of Humic substances in freshwaters. Springer, New York.

Stevenson, F.J., 1994. Humus Chemistry. Genesis, Composition, Reactions. (2nd Edn.), John Wiley and Sons, New York.

Tan, K.H., 2003. Humic matter in soil and the environment. Marcel Dekker, New York.

TeraVita, TM., 2004. Humates in poultry and stock farming. http://www.teravita.com/Humates/Chapter9.htm

Yalçin, S., S. Özkan, Z. Açikgöz and K. Özkan, 1999. Effect of dietary methionine on performance, carcass characteristics and breast meat composition of heterozygous naked neck (Na-1na+) birds under spring and summer conditions. Br. Poult. Sci., 40: 688-694.

Yasar, S., A. Gokcimen, I. Altunas, Z. Yonden and E. Petekkaya, 2002. Performance and ileal histomorphology of rats treated with humic acid preparations. J. Anim. Phys. Anim. Nutr., 86: 257-264.

Yoruk, M.A., M. Gul, A. Hayirli and M. Macit, 2004. The effects of supplementation of humate and probiotic on egg production and quality parameters during the late laying period in hens. Poult. Sci., 83: 84-88.