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Use of Halfa Bar Essential Oil (HBO) as a Natural Growth Promoter in Broiler Nutrition

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Abstract: This experiment was conducted to evaluate the response of broiler chicks to diets containing graded levels of essential oil extracted from Halfa Bar Oil (HBO). A total of 160, five days-old, unsexes (Ross 308) broiler chicks were used. Chicks were weighed individually and assigned randomly to five groups of 32 chicks per treatment and each treatment group consisted of four replicates of 8 chicks per each. Five experimental diets were formulated (A, B, C, D and E) to meet the nutrient requirements. The experimental parameters covered growth performance, carcass characteristics serum metabolite, electrolyte and enzyme activities. Diets A as Negative Control (NC), diet B control diet supplemented with antibiotic (Neomycin 16 mg/Kg) as Positive Control (PC), diets C, D and E were NC supplemented with Halfa Bar Oil (HBO) at 50, 100 and 150 mg/Kg, respectively. Result obtained showed that addition of HBO improved significantly ($P \leq 0.05$) the performance (body weight gain, feed intake and feed conversion ratio) of broiler chicks compared to group fed on NC while no Significant ($P \leq 0.05$) differences between chicks fed on diets supplemented with HBO and PC group observed. The mortality rate did not influenced by the dietary treatments. Results revealed no significant differences ($P \leq 0.05$) among all treatment groups in the percentages of carcass dressing, giblet, commercial cuts and their percentage of their separable tissue, meat chemical composition and subjective meat quality parameters. Supplementation of HBO in the broiler diets at various levels resulted in significant ($p > 0.05$) reduced of serum cholesterol, urea and ALP enzyme activity compared to both NC and PC groups while the level of total protein, calcium, phosphorus and AST remained unchanged. Economically the addition of HBO improved the performance of broiler chicks and resulted in economical benefits. This study showed that HBO when added as growth promoter in broiler diets has a similar effect as that with antibiotic without any adverse effects.

Key words: Growth promoter, serum metabolite and electrolyte

INTRODUCTION

Feed for poultry is formulated to contain an optimum nutrient concentration obtainable at reasonable cost for desirable growth, production and efficiency of feed utilization, so certain non nutritive feed additives are sometimes used, antibiotics were used as growth promoters in poultry diets in many European countries and United States of America (Leeson and Summers, 2001).

Many scientific findings suggested that antibacterial used for animal feeding as growth promoter became risky for human and animal health (Manning *et al*., 1994). So, since 2006 the use of antibiotics growth promoters is prohibited in the European Union (Buchanan *et al*., 2008). Therefore, scientists have searched for alternatives. Herbs, spices essential oils extracted form aromatic plants, enzymes, organic acids and probiotics all shown promising results for use in organic poultry production (Griggs and Jacob, 2005).

Halfa bar, the common name of Cymbopogon, family Grammineae is a perennial plant, grow up word in a form of collected branches, with along and thin leaves, red flowers and small capsules carrying seeds, a common weed, with strong aromatic odor grows in southern Egypt and northern Sudan. Leaves (the important part) contain volatile oil from 0.4-o.7%. The plant widely used as an effective renal antispasmodic and diuretic (Batanouny *et al*., 1999). The volatile oil showed ovicidal, larvicidal and antioxidant activities (Minute *et al*., 2000). The literature lacks data about the pharmacological effects of the oil on different organs. Analysis revealed that the oil contains only eight components with piperitone forming 72.44% of the oil, other minor components of the oil such as elemol and beudesmol are known constituents of the plant (Elgamal and Wolff, 1987).

MATERIALS AND METHODS

The experiment was conducted during winter season (1th Feb-14th March 2009) the ambient temperature ranged between 20-45^{o}C. A total 160 one-day old, unsexed (Ross 308) were transported to Poultry Farm,

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College of Agriculture Studies, Sudan University of Science and Technology. Chicks were weighed and randomly assigned to five groups in a completely randomized design. Each treatment was further subdivided into four replicates of eight chicks per each and kept in an opened house. Feed and water were provided *adlibitum*. Light was provided 24 hours in a form of natural during day and artificial light during the night.

Halfa Bar Oil (HBO) used was purchased from Industrial Research and Consulting Center, Khartoum State (the oil was prepared by a hydro distillation extract). The chicks were also purchased from commercial local company and were fed on experiments dietary. The first group A, fed on basal diet Negative Control (NC) without growth promoter. The second group B fed on basal diet containing an antibiotic (Neomycin 16 mg/kg) as chemical growth promoter Positive Control (PC), the other groups C, D and E were fed on basal diet supplemented with (HBO) at 50, 100 and 150 mg/kg, respectively. The basal diet was formulated to meet the nutrient requirement of broiler chicks according to NRC (1994). Chicks were weighed weekly and feed consumption was determined at the time of weighing, body weight gain and Feed Conversion Ratio (FCR) were calculated, Venous unheparinized blood samples were taken to determine plasma constituents using commercial kits, before slaughtering, were centrifuged at 3000 r.p.m. for 5 minutes and sera were stored at -20^{o}C until analyzed for concentrations of metabolites, total protein, cholesterol, urea, enzyme activities, ALP, AST and minerals. Using spectrophotometer (Hitachi-902, Germany).

At the end of the experiment chicks were fasted overnight except from water, weighed individually. Slaughtered, scaled after bleeding. Hand plucked, washed and eviscerated, Hot carcasses, edible inner organs (liver, gizzard and heart) were weighed separately. The carcass was divided into two halves, the left side was divided into commercial cuts (breast, thigh, drumstick), then each cut was weighed and deboned, the meat of cuts frozen and stored for panel test and chemical analysis. Duplicate samples of meat used for chemical analysis according to AOAC (1988).

Data collected in performance, carcass characteristics, serum metabolites and enzyme activities beside slaughter, carcass yield and quality were subjected to analysis of variance using one-way analysis of variance (ANOVA), means were further subjected to Duncan's multiple range tests (Duncan, 1955).

RESULTS

The effect of feeding different levels of dietary HBO on the performance or 6 weeks broiler chicks was shown in Table 1. The results indicated that chicks of groups B, C, D and E obtained significantly ($P<0.05$) higher Body Weight Gain (BWG), Feed Intake (FI) and had significantly ($P<0.05$) better FCR compared to control group NC while there was no significant ($P>0.05$) difference observed between groups B, C, D and E in the above parameters throughout the experimental period. The treatment had no significant ($p>0.05$) effect on mortality rate.

Results showed no significant ($p>0.05$) differences (Table 2) between all treatments groups in weight of carcass cuts, dressing percentage, edible inner organs

Table 1: The effect of different dietary levels of HBO and antibiotic on the performance of broiler chicks fed (6) weeks

Items	Control	B	C	D	E	SE
Initial weight g/b	71.0	71.0	71.0	71.0	71.0	
Final weight g/b	1511.0^{b}	1606.0^{a}	1607.0^{a}	1616.0^{a}	1621.0	
Weight gain g/b	1440.0^{b}	1533.0^{a}	1536.0^{a}	1545.0^{a}	1550.0^{a}	6.135
Feed intake g/b	3260.0^{b}	3289.0^{a}	3271.0^{a}	3281.0^{a}	3291.0^{a}	3.425
FCR	2.26^{a}	2.15^{a}	2.13^{a}	2.12^{a}	2.12^{a}	0.00015
Mortality (%)	0.5	0.25	0.3	0.25	0.4	0.04

SE: Standard error; A: Control; B: Antibiotic; C, D and E supplemented with HBO at 50, 100 150 mg/kg, respectively.
Means in a row bearing the same letter or no letter superscripts do not differ significant ($p>0.05$).

Table 2: The effect of feeding broiler chicks on diets containing antibiotic and different levels of HBO on percent of carcass, giblets and commercial cuts of broiler chicks

Items	A	B	C	D	E	SE
Dressing (%)	70.0	70.1	70.15	70.17	70.19	0.132
Gizzard (%)	2.72	2.73	2.78	2.79	2.79	0.0258
Heart (%)	0.81	0.83	0.79	0.82	0.84	0.0996
Liver (%)	2.42	2.51	2.49	2.51	2.53	0.1463
Breast (%)	24.41	24.46	24.41	24.46	24.5	0.2074
Drumstick (%)	19.1	19.11	19.11	19.14	19.17	0.01826
Thigh (%)	19.31	19.33	19.29	19.30	19.35	0.1751
Breast meat (%)	80.79	81.81	81.83	81.86	81.88	0.2983

SE: Standard error; A: Control; B: Antibiotic; C, D and E supplemented with HBO at 50, 100 150 mg/kg, respectively.
Means in a row bearing the same letter or no letter superscripts do not differ significant ($p>0.05$).

Table 3: The effect of feeding broiler chicks on diets containing antibiotic and different levels of HBO on meat chemical and subjective values of broiler chicks

Items	A	B	C	D	E	SE
Crude protein (%)	17.65	17.49	17.48	17.45	17.48	0.4601
Ash (%)	1.34	1.30	1.31	1.31	1.33	0.0948
Moisture (%)	70.57	70.55	70.51	70.53	70.52	7.497
Ether extract (%)	4.54	4.55	4.56	4.54	4.55	0.2236
Juiciness	6.00	6.13	6.00	6.20	6.10	0.2702
Tenderness	6.67	6.53	6.30	6.40	6.17	0.2608
Color	6.20	6.10	6.20	6.00	6.10	0.2212
Flavor	6.17	6.17	6.30	6.50	6, 40	0.1683

SE: Standard error; A: Control; B: Antibiotic; C, D and E supplemented with HBO at 50, 100 150 mg/kg, respectively.
Means in a row bearing the same letter or no letter superscripts do not differ significant (p>0.05).

Table 4: The effect of feeding broiler chicks on diets containing antibiotic and different levels of HBO on serum metabolite value and serum electrolyte and enzyme activities of broiler chicks

Items	A	B	C	D	E	SE
Cholesterol mg/dl	139.9[a]	140.0[a]	106.5[b]	106.3[b]	104.3[b]	1.463
Total protein g/dl	3.20	3.15	2.90	2.78	2.75	0.156
Urea mg/dl	12.9[b]	12.95[b]	11.20[a]	11.00[a]	10.10[a]	0.1366
Calcium mg/dl	7.90	8.80	8.33	8.60	8.00	0.2288
Phosphorus mg/dl	11.38	11.20	11.20	11.34	11.00	0.1571
AST (iu/L)	24.5	24.2	24.42	24.18	23.89	0.2049
ALP (iu/L)	232.0[a]	200.0[a]	157.0[b]	167.8[b]	158.4[b]	6.138

SE: Standard error; A: Control; B: Antibiotic; C, D and E supplemented with HBO at 50, 100 150 mg/kg, respectively.
Means in a row bearing the same letter or no letter superscripts do not differ significant (p>0.05).

(liver, gizzard and heart), meat chemical composition (crude protein, moisture, ash and ether extract) aspects and subjective meat values (Table 3). Although the scores given for color, juiciness, flavor and tenderness were acceptable and above moderate.

Serum metabolite mean values of urea and cholesterol results were lower significant (p>0.05) for groups fed on HBO compared to control and antibiotic groups, where was no significant difference observed between groups fed on diets with HBO. The treatment effect on phosphorus, calcium and AST enzyme activity showed no significant (p>0.05), where as mean values of ALP in groups A and B were higher significant (p<0.05) compared to other tested groups (Table 4).

Economically HBO can be used as natural growth promoter instead of antibiotic growth promoter without any adverse affects and chicks fed on group D recorded the profitability ratio.

DISCUSSION

The experimental chicks health was good although out the experimental period, the mortality rate was negligible with no differences among all treatment groups. Dietary HBO had no significant effect on mortality rate and this was agreed with the reports of Ismail (2011).

Results showed that chicks fed diets supplemented with HBO consumed significantly more feed compared to control group, where as no significant differences were observed when compared with antibiotic group. This might be due to improvement in the feed taste, diet palatability enhancing chicks appetite (Hernandez *et al*., 2004), or due to quicker digestion and passage of nutrients through the digestive tract (Tekeli *et al*., 2011). These findings were similar to that of Ismail, (2011).

Concerning body weight gain, results recorded showed the trend to that obtained for feed consumption. The improvement may attributed to increase of total feed intake/or relate to content of active compounds of HBO such as piperitin and limonene, posses antimicrobial activities (Arslan *et al*., 2005) antioxidant activities (Minute *et al*., 2000 and Ismail, 2011).

The positive effects of HBO on body weight gain related to its biological functions that could act not only as antimicrobial and antioxidant but also as stimulant of digestive enzymes in the intestinal mucosa and pancreas that improve digestion of dietary nutrients and feed efficiency subsequently increasing growth rate (Hernandez *et al*., 2004). These results also supported with findings of Mukhtar (2011); Hernandez *et al*. (2004); and Tekeli *et al*. (2011), who reported positive effects of essential oils on body weight gain of broilers. These results disagreed with Lee *et al*. (2003a) who stated that commercial essential oils mixture did not affect BWG of female broiler chicks.

The same results were recorded for FCR. The improvement of FCR resulted from the increase in appetite due to the stimulating of salivary and gastric glands by HBO, the decrease in pathogenic bacteria and better digestibility. The findings were in line with those of Osman, 2005; Mehmet *et al*., 2005 and Tekeli, 2011. Although, the results were disagreed with the findings of Ismail (2011), who found no significant effects on FCR of broilers chicks when fed on ration supplemented with black cumin oil.

Results showed that dietary HBO at various inclusion levels performed similar to antibiotic growth promoter group on body weight gain, feed intake and feed conversion ratio for broiler chicks, this might be attributed to the decrease number of pathogenic bacteria and/ the formation of a more stable intestinal flora and better digestion. These results agreed with the report of Mohan (2004); Tekeli *et al*. (2011).

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