J. Animal and Poultry Prod., Mansoura Univ., Vol. 2 (4): 55 - 63,*2011*

EFFECT OF HUMIC ACID AND BIO-MOS SUPPLEMENTATION ON EGG PRODUCTION AND QUALITY PARAMETERS IN LOCAL HENS.

Abo-Egla, El-Samra H.* ; F. S. A. Ismail*; F. A. Abd El-Ghany and M. H. Assar****

*** Dept. of Poultry Production, Fac. Agric, Mans. Univ.**

****Animal Production Res. Inst., Agric. Res. Center. Dokki, Giza.**

ABSTRACT

This study was designed to investigate the inclusion effect of humic acid (HA) and mannanoligosaccharide (Bio-Mos) into laying hen diets on egg production and egg quality. Gimmizah layers (n=210) 30 wk of age were fed a control diet , 0.1 , 0.2 and 0.3% humic acid and 0.1 , 0.2 and 0.3 % Bio-Mos for 90 days . Feed consumption was measured weekly and feed conversion was calculated.. Mortality was recorded daily. The number of eggs and egg weight were recorded daily throughout the experimental period. Also a sample of 30 eggs from each group was collected randomly to determine egg quality every 30 days. The results were summarized as follow: egg weight and egg production for hens supplemented with humic acid and Bio-Mos were significantly increased compared with the control group. Dietary treatments had insignificant effect on feed intake. No significant effect of humic acid or Bio-Mos had insignificantly effect on egg shape index, albumin (%), Haugh unit and egg yolk index. Whereas, egg shell thickness was significantly ($p<0.05$) increased compared with the control group. In conclusion, supplementation of humic acid and Bio-Mos during laying period significantly increased egg production, egg weight and improved egg shell quality.

INTRODUCTION

Using alternatives to antibiotic growth promotants in commercial chickens have become important mainly because of apprehension about the possible development of resistant bacteria. At the same time, continuous use of antibiotic growth promotants in breeders may have one important ramification that could affect the poultry industry, reduction in the efficacy of antibiotics when used in progeny that are hatched to the same parents (Shashidara and Devegowda ,2003). Also, antibiotic growth promotants resulted in the occurrence of resistant microorganisms which become one of the major problems in human medicine.

Humic acid (HA) is resulting from decomposition of organic matter, particularly plants, and it is natural components of drinking water , soil and lignite , moreover , it has been used as an antidiarrheal ,analgesic , immunostimulatory and antimicrobial agent in veterinary practices in Europe (EMEA, 1999). Many experimental studies have shown HA to be nontoxic and nonteratogenic (EMEA, 1999 and Yasar *et al.,* 2002) .

Humates are the salts of humic acid in which the exchange site is Ca+, Na+, AL+ and Fe+2 rather than hydrogen (Humin Tech, 2004). Previous studies with respect to humates have focused mainly on the growth of germinal tissue in seed. The idea of using humates as feed additives in

animal nutrition is new. Humates have been used for their anti-inflammatory, antioedematous , anti-bacterial and antiviral effects on animals (Joone *et al.,* 2003). The concept of using humates as an alternative feed additive in animal nutrition has gained increasing importance, particularly after the ban on antibiotic use in feeds as growth promoters.

Bio-Mos is derived from the outer cell wall of yeast. Mannose, the main component of Bio-Mos, is a unique sugar because many enteric bacteria have receptors that bind to it (Griggs and Jacob, 2005). The Bio-Mos supplementation is considered become it is not only shifts gastrointestinal microflora balance toward beneficial organisms (Spring at al., 2000; Fairchild *et al.,* 2001) , but also resulted in significant improvement in antibody responses in broiler and layers (Cotter *et al.,* 2000; Cotter *et al.,* 2002 and Raju and Devegowda, 2002).

The objectives of this study were to investigate the effects of supplementation of humic acid and Bio-Mos on egg production and egg quality parameters of local hens.

MATERIALS AND METHODS

Birds, Diet and Management:

A total of 210 hens from Gimmizah strain at 30 weeks of age and with uniform BW, were placed in floor pens. They were then assigned randomly to be fed 1 of 7 isocaloric and isointrogenous experimental diets: a basal diet containing neither humic acid nor Bio-Mos and diets containing either humic acid (0.1, 0.2 and 0.3%) or Bio-Mos (0.1, 0.2 and 0.3%). Each treatment was replicated in 3 pens with 10 hens each. Each kilogram of humic acid contained 85% polymeric polyhydroxy acid, 10% phosphorus, 2% magnesium, 2% sulpher and 1% trace minerals (iron, zinc and manganese). The Bio-Mos preparation used in these studies was the commercial product Bio-Mos® produced by Alltech, Nichola Siville, Kentucky USA.the composition of the basal experimental diet was presented in table 1. Water was available all the times and lighting program of 16 hours a day was applied.

Criteria of response:

Individual body weights were recorded at the beginning and at the end of the study to calculate body weight changes. Feed consumption was measured weekly and feed conversion ratio was calculated. Mortality was recorded daily. The number of eggs and egg weight were recorded daily through the experimental period (90 days). An additional sample of 10 eggs was randomly collected from each experimental group every 30 days to assess egg quality parameters as egg shape index % (Carter, 1968) and yolk index % (Well 1968). Haugh units, as an indicator for albumen quality was calculated using the HU formula (Eisen *et al.,* 1962). Shell thickness was determined at three locations on the egg (air cell, equator and sharp end) by using a micrometer.

Statistical analysis:

Analysis of variance was computed using the general linear model (GLM) procedure of statistical analysis system according to SPSS (1999). Significant differences among means were evaluated using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Body weight change and mortality rate:

Results in Table 2 indicated that humic acid and Bio-Mos supplementation had insignificant effect on body weight change.

Mortality rate for hens fed the control diet was not different from that for hens fed humic acid and Bio-Mos diets. The mortality rate was also not different among hens fed humic acid and Bio-Mos diets. There was also no effect of increasing the level of supplemental humic acid on mortality (Table 2). Autopsy findings revealed that deaths were related to noninfectious causes. Little is known about the mechanism by which humic acid supplementation enhances the life span and improves production efficiency. However, available data consistently suggest that humic acid supplementation of Na humate in rats exposed to lethal doses of radioactivity increased the life span. In similar studies, it was shown that after high doses, supplemental humate alleviated toxicity of Cr in fish (Stockhouse and Benson, 1989) and Cd in chickens (Herzig *et al.,* 1994) by reducing deposition of toxic metals in organs. Supplementation with Bio-Mos has also been shown to enhance survival by altering gastrointestinal flora (Patterson and Burkholder, 2003) to suppress growth of pathogenic bacteria (Cotter *et al.,* 2002) and by enhancing immune potency (Cotter *et al.,* 2000).

Feed intake and egg production:

The experimental diets had no effects on feed intake (Table 2). Similar results was obtained by yoruk *et al.,* (2004) who found that humate with concentration of 0.1 and 0.2 % had no significant effect on feed intake in late stage of laying . Also, in broiler chickens, Kocabagli *et al.,* (2002) indicated that no significant effect on feed consumption was observed when birds group fed diet with humate . While, Kucukersan *et al., (*2005) showed that the average daily feed consumption of hen fed diets with humic acid was significantly ($p \leq 0.05$) decreased compared with the control group. The mechanism by which humic acid effects poultry performance is largely unknown, whereas it is well established that Bio-Mos alter gastrointestinal PH and flora to favor on increased activity on intestinal enzymes and digestibility of nutrients (Shin *et al.,* 2005). In similar studies involving broilers, \despite a lack of feed intake data, it was reported that supplementation of humate (Kocabagli *et al.,* 2002) did not alter feed conversion efficiency on day 21, but improved it on day 42. It appears that supplementation of humate and Bio-Mos do not improve growth by affecting feed intake per se , suggesting that improvement in weight gain and reduction in feed conversion efficiency by supplemental humic acid and Bio-Mos could be related to their promoting effects on metabolic processes of digestion and utilization of nutrients (Yeo

and Kim, 1997). Also, Table 2 showed that either of the dietary supplementation level of humic acid and Bio-Mos had a significant effect on egg weight and egg production percentage during the experimental period (12 weeks). Moreover, humic acid at 0.1 % - 0.2% and Bio-Mos at 0.2% - 0.3% caused a significant ($p < 0.05$) increase in egg weight and egg production percentage compared with the control group. These results are consistent with those reported by Kucukersan *et al.,* (2005) who showed that the dietary humic acid at doses of 30 and 60 g/ton feed can be used to improve egg weight and egg production.

Yoruk *et al.,* (2004) found that supplementation of humate in layer diets at 0.1 and 0.2 % for 75 days during the late laying period caused egg production increase compared to control group. On the other hand, Wang *et al.,* (2007) indicated that the dietary humic substances at 5 or 10%.decreased egg production but egg weight was improved. The addition of Bio-Mos with levels (0.2 - 0.3%) improved egg weight and egg production. These results agree with Guerrero, (1995); Berry and Lui, (2000) and Stanley *et al.,* (2000) reported considerable improvement in egg production and egg weight in the Bio-Mos fed birds. Shermer *et al.,* (1998) who showed that the humic acid stabilizes the intestinal microflora and thus ensures an improved utilization of nutrients in animal feed. This leads to an increase in egg production and egg weight of laying hens. Talay *et al.,* (2004) and Zhigang *et al.,* (2004), found that Bio-Mos were significantly resulted in heavier body weight than unsupplemented diet (control diet). In the present study the increase in egg production and egg weight may be attributed to adsorption of toxin and pathogenic bacteria (Dawson, 2002), improved protein digestibility (Bonomi *et al.,* 1978)

There was no difference in feed conversion efficiency of hens fed humic acid and Bio-Mos diets. However, there were slightly improvement in feed conversion efficiency for hens fed humic acid at level (0.1 and 0.2%) and Bio-Mos at levels (0.2 - 0.3%) compared with hens fed the control diet (Table 2). These results are in agreement with results of studies involving broilers on supplementation of humate (Zhorina and Stepchenko, 1991; Kocabagli *et al.,* 2002). Similar results of insignificant FC improvement were found in laying hens and Japanese quail at the same level of Bio-Mos supplementation were reported by Chukwu and Stanley (1997) and Ghosh *et al.,* (2007).

Egg quality:

It was observed that there were no significant differences among treatments with respect to egg shape, albumen percentage, Haugh unit and yolk index (Table3). These traits were not affected by addition of humic acid or Bio-Mos to layer hen diets during the experimental period. The obtained results approach with those found by Yoruk *et al.,* (2004); Kucukersan *et al.,* (2005) and *Wang et al.,* (2007). Egg shell thickness significantly ($p \leq 0.05$) increased for hens fed either levels of humic acid or Bio-Mos compared with control with control group (Table 3). The increases in egg shell thickness were more pronounced when hens fed diet with high level of humic acid. These results approach with those reported by wang *et al.,* (2007) who indicated that the egg shell breaking strength as indicator of shell thickness was increased for hen fed diets with humic substances compared with the

control group. An earlier report by Chen and Balnave (2001) suggested that Carbonic anhydrase played an important role in egg shell formation, and showed optimal activity in slightly alkaline medium. We concluded in our study that humic acid might have improved egg shell calcification by increasing blood Na and K levels, or causing other Cation-anion changes. Although not well known yet, these types of metabolic events in the body may be one reason to the positive effect on egg shell quality.

Regarding of Bio-Mos supplementation resulted in significant increase in shell thickness (Table 3). Similarly, Berry and Lui (2000) and Shashidhara and Devegowda (2003) reported that the Bio-Mos improved egg shell quality traits in older breeder females, may be due to improvement in calcium availability. The obtained results indicated that humic acid and Bio-Mos has improved egg production, feed conversion, and egg shell quality. The positive effects of humic acid, possibly related to improved nutrient utilization through various metabolic activities in the body are yet to be further investigated.

Also different investigators showed that Bio-Mos maintain gut health by adsorption of pathogenic bacteria containing different bacterial strains and remove the pathogenic bacteria from gut (Oyofo *et al.,* 1989 and Spring *et al.,* 2000) and increase villus height, uniformity and integrity also, increase in Crypt depth is attributed to greater expenditure of energy to develop the absorptive surface (Dawson and Tricarico, 2002; Loddi *et al.,* 2002; oliveira *et al.,* 2006 and Ghosh *et al.,* 2007).

Table (1): Composition and calculated analysis of the basal diet fed to experimental birds.

Ingredients	**%**
Yellow corn	64.00
Soybean meal (44%)	24.78
Limestone	7.91
Di-calcium phosphate	1.61
Wheat bran	1.00
Salt (Nacl)	0.30
Vit.& Min. Mixture*	0.30
DL.Methionine	0.10
Total	100
Calculated analysis	
Metabolizable energy (kcal/kg)	1713.00
Crude Protein, %	16.03
Crude fiber, %	3.39
Crude fat, %	2.84
Calcium, %	3.34
Available phosphate, %	0.42
Lysine, %	0.89
Methionine, %	0.39
Met+Cystine, %	0.66

***Supplied per kg of diet: vit.A, 10000 IU; D_3, 2000 IU; Vit.E, 10mg; Vit.K_3,1mg; vit.B_1, 1mg; vit. B_2, 5mg; vit.B_6, 1.5mg; vit. B_{12}, 10mcg; Niacin, 30mg; Pantothenic acid, 10mg; Folic acid, 1mg; Biotin, 50µg; Choline, 260mg; Copper, 4mg; Iron; 30mg; Manganese, 60mg; Zinc, 50mg; Iodine, 1.3mg; Selenium, 0.1mg; Cobalt, 0.1mg.**

Table (2): The effect of supplementation of humic acid and Bio-Mos on performance and production parameters of hen.

Parameters	control	Humic Acid (%)			Bio-Mos (%)			SEM	Sig.
	0	0.1	0.2	0.3	0.1	0.2	0.3		
Initial body weight	1503	1498	1505	1501	1515	1503	1498	±15.17	N.S
Final body weight	1710	1726	1778	1730	1750	1740	1773	±29.19	N.S
Body weight changes (%)	12.08	13.22	15.36	13.19	13.41	13.60	15.48	±1.25	N.S
Absolute	2/30	1/30	-	2/30	1/30	-	1/30	±	N.S
Mortalityrate (%)	6.66	3.33	-	6.66	3.33	-	3.33		
Feed intake (g/h/d)	100.66	100.81	100.97	101.14	102.08	100.53	102.28	±0.35	N.S
Egg weight (g)	48.25^{c}	49.29^{b}	49.80^{a}	49.24^{b}	49.21^{b}	49.58^{ab}	49.87^{a}	±0.29	*
Egg Production(%)	49.40^{c}	50.12^{b}	52.34^{a}	49.21^{c}	50.12^{b}	51.82^{ab}	52.62^{a}	±0.85	*
Feed conversion ratio	4.13	4.08	3.89	4.19	4.14	3.91	3.92	±0.60	N.S

Table (3): The effects of supplementation of humic acid and Bio-Mos on egg quality parameters of hens.

Parameters	Control	Humic Acid (%)			Bio-Mos (%)			SEM	Sig.
	0	0.1	0.2	0.3	0.1	0.2	.03		
Yolk (%)	32.45	32.27	32.28	31.96	32.52	32.02	32.11	±0.58	N.S
White (%)	56.59	56.93	56.44	56.89	56.45	56.99	56.61	±0.86	N.S
Shell (%)	10.95	10.78	11.27	11.14	11.02	10.98	11.27	±0.70	N.S
Yolk index (%)	45.49	45.22	46.89	45.25	45.87	46.76	46.43	±0.48	N.S
Haugh unit	88.34	88.50	90.60	88.46	89.0	90.52	89.36	±1.25	N.S
Shell thickness(mm)	0.370c	0.380c	0.400ab	0.410a	0.378c	0.396ab	0.390ab	±0.02	*
Egg shape index	76.86	76.81	77.32	76.96	77.01	77.21	76.95	±1.36	N.S

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تأثير إضافة حمض الهيومك و البيوموس على إنتاج البيض وصفات جودة البيض في الدجاج المحلي

السمرة حسن أبو عجلة*, فوزي صديق عبد الفتاح اسماعيل*, فوزي علي عبد الغني و محمد حسني عصر****

*** قسم انتاج الدواجن- كلية الزراعة- جامعة المنصورة.**

**** معهد بحوث الانتاج الحيواني- مركز البحوث الزراعية- الدقي- الجيزة.**

د

صممت هذه الدراسة لبحث اضافة حمض الهيوميك والمنان اوليجو سكريد في علف البياض على انتاج البيض وجودة البيض تم استخدام دجاج الجميزة البياض (عدد210) عمر 30 اسبوع حيث تغذت على علف كنترول , 0.1 , 0.2 و 0.3% حمض الهيوميك أو 0.1 , 0.2 و 0.3% منان اوليجو سكريد لمدة 90 يوم تم قياس انتاج البيض و العلف المستهلك ووزن البيض يوميا . وتم ايضا أخذ 30 بيضة من كل مجموعة لتحديد جودة البيض مرة كل 30 يوم.

يمكن تلخيص النتائج في الآتي :

زاد وزن البيض وانتاج البيض للدخاج المغذى على عليقة مضاف اليها حمض الهيوميك و البيوموس بالمقارنة بمجموعة الكنترول ولم تؤثر المعاملات الغذائية على العلف المستهلك . لم يكن هناك تأثير معنوي للاضافات الغذائية على دليل شكل البيضة - الالبيومين % - ووحدات هوف ودليل صفار البياض في حين سمك القشرة زاد معنويا بالمقارنة بمجموعة الكنترول .

الخلاصة : أن اضافة الهيوميك و البيوموس خلال فترة الانتاج يزيد انتاج البيض ووزن البيض ويحسن جودة القشرة .

قام بتحكيم البحث

أ.د / خليل الشحات شريف	**كلية الزراعة – جامعة المنصورة**
أ.د / حسن صابر زويل	**كلية الزراعة – جامعة الاسكندرية**