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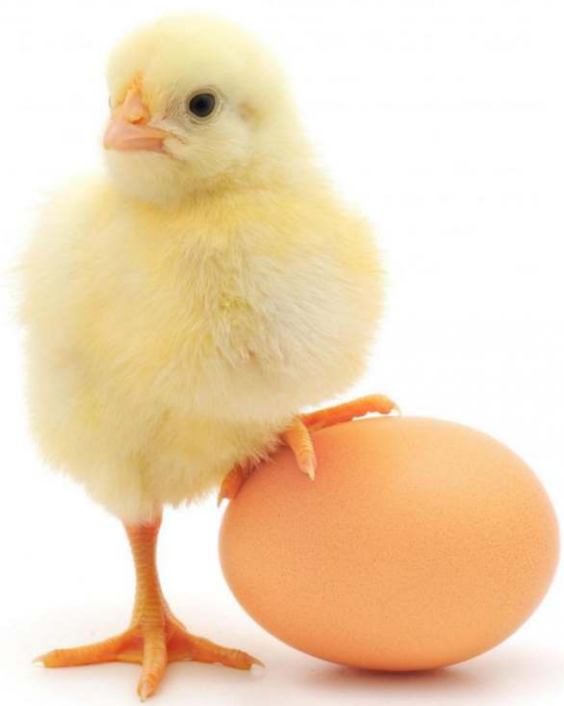

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Effect of Adding Biomin as a Natural Growth Promoter on Productive Performance, Some Haematological and Immunological Traits of Broiler Chicks

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Abstract: The objective of the present study was to investigate the effect of adding Biomin as a natural growth promoter in drinking water on the productive performance, some hematological and immunological parameters in broiler chicks. A total of 180 unsexed, one day old, broiler chicks (Hubbard) were weighed, wing banded and randomly classified to three equal groups. All chicks in the 1st group were watered fresh tap water during the experiment, while those in the 2nd and 3rd groups were orally received fresh tap water including 20 and 30 mg Biomin/chick during the first three days of age. All chicks were fed on commercial basal diets *ad libitum* and daily exposed to 24 lighting hours allover experimental period. All birds were reared on a partitioned deep litter floor. The obtained results could be concluded as follow: The oral administration of Biomin to broiler chicks increased ($p<0.05$) body weight and body weight gain from 2 to 6 weeks of age in the treated groups than those of the control. The treated broilers chicks with Biomin at 20 and 30 mg/chick consumed less feed intake and had better feed conversion ratio all over experimental period than those of the control. Hemoglobin, hematocrit (%), globulin, total lipids, glucose and ALT for chicks orally received biomin at 20 and 30 mg/bird insignificantly affected as compared to control. Total cholesterol level in the treated group decreased significantly ($p<0.05$) at 2 and 4 weeks of age as compared with those of control. Creatinine and AST levels for treated chicks were significantly affected by the Biomin administration at 4 and 6 weeks of age. Humoral immune response for treated chicks against sheep red blood cell (SRBC, s) insignificantly increased as compared with control chicks. Similarly, the immune response (Antibody titer) for Newcastle disease (ND) was insignificantly affected with Biomin treatment.

Key words: Biomin, productive performance, immune responses, blood parameters and broiler chicks

INTRODUCTION

Since the 1940's, antibiotics have been used as growth promoters in the poultry feed and water to prevent gut infections and inhibit bacteria activities (Plail, 2006). In the late 1990's in Europe, many researchers clear that there was a great scientific pressure to remove the antibiotic growth promoters in poultry farm (European Commission, 2003). Therefore, their use antibiotic in feed and water has been banned by the European Union since 2006, due to the deleterious effects on broiler performance (Castanon, 2007). Nowadays, many studies (Akinleye *et al*., 2008; Peric *et al*., 2009) recommended the use of natural growth promoters as probiotics, prebiotics and enzymes to prevent gut diseases, enhance productive performances as well as to decrease the costs of medication during the production period.

Probiotics are live microbial food supplement, which positively influence treated animals and birds through promoting its intestinal microbial balance and excluding the colonization of pathogens (Montes and Pugh, 1993; Chichlowski *et al*., 2007; Roofchaee *et al*., 2011), to produce antimicrobial substances, which stimulate immune response for birds under different stresses as vaccination and feed changes (Perdigon *et al*., 1995). On the other hand, prebiotic is a food ingredient that is not digested in the upper gut, which stimulates the growth and activity in poultry, while synbiotics, are the combination of probiotics and prebiotics (Rozbeh Fallah *et al*., 2014). The supplementation of synbiotics in broiler chicks regulates the organic acids concentration and reduces cholesterol levels in rats (Liong and Shah 2006) as well as causes better absorption of glucose in the broiler chicks (Awad *et al*., 2008). Similarly, numerous studies have demonstrated that providing newly hatched chicks with some substances containing a stabilized probiotic strain of Enterococcus faecium, the prebiotic fructo-oligosaccharides which out compete pathogens and the immune-stimulating substances like cell wall fragments (Mustafa, 2009; Akinleye *et al*., 2008; Mohammad Amin and Qubih, 2011; Samli *et al*., 2007).

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Also, Mohnl (2006) found that broilers weight gain and feed conversion during 40 days improved by applying a multi strain probiotic in drinking water at 3 periods in the production cycle of broilers (1-3; 10-12 and 18-20 days of age). Similarly, Rodrigues *et al.* (2005) showed that administration of prebiotics had improved weight gain, feed intake and feed convention rate of broilers. To reduce the hazardous effects caused by antibiotics, a company produced Biomin in the Europe in 1999 as a natural growth promoter, which can be administered in the feed and water (Akinleye *et al.*, 2008; Erfani Majd *et al.*, 2014).

The objective of this study was to evaluate the effect of adding Biomin as a natural growth promoter on the productive traits, some hematological and immunological parameters of broiler chicks.

MATERIALS AND METHODS

This study was conducted at the Poultry Nutrition Research unit, Department of Animal and Poultry Production, Faculty of Agriculture, Cairo University, Giza, Egypt.

Experimental birds and design: One hundred and eighty, one-day old, unsexed Hubbard chicks were weighed and randomly divided into three equal groups and 4 replicates on a partitioned deep litter floor under cyclic temperatures (min, 24°C; max, 34°C and 60 to 80% RH). In the 1st group (control), chicks were watered fresh tap water during the experiment, while those in the 2nd and 3rd groups were orally received fresh tap water including 20 and 30 mg Biomin/chick during the first three days of age. All chicks were daily fed on commercial basal diets *ad libitum* under normal and hygienic conditions and exposed daily to 24 continuous lighting hours during the first three days of age.

Experimental diet: The basal diets (mash form) were formulated to exceed requirements by the NRC (1994) for broiler chickens as presented in Table 1. The starter, grower and finisher diets were provided from d 1 to 21; 22 to 35 and 36-42 day, respectively. Chicks were fed and watered fresh tap water *ad libitum* allover the experimental period.

Studied traits

Productive performance: All chicks were weighed individually (48 g initial weight) after their arrival from the hatchery to the experimental farm and then weekly weighed up to 7 weeks of age. Weekly weight gain for each group was calculated. Feed intake was weekly recorded for each group and subsequently the feed conversion ratio was calculated.

Haematological study: At different weeks of age all over experimental period, 10 samples from each group, about 2 ml/bird were collected from their jugular veins. Hemoglobin (Hb) concentration (g/dl) and packed cell volume (PCV %) are determined immediately before serum separation by blood centrifugation 3000 x g for 15 min according to the procedure of Maff (1984).

Table 1: Ingredient composition and calculated chemical analysis of the basal diets

Ingredients	Starter (0- 21) day	Grower (22- 35) day	Finisher (36- 42) day
Corn yellow	60.5	65	67.5
Soybean meal 48%	30.8	25	22
Corn gluten meal 60%	4	3.5	3.5
Corn oil	-	1.8	2.3
Ground limestone	1.4	1.4	1.4
Dicalcium phosphate	2.3	2.3	2.3
Salt (NaCl)	0.35	0.35	0.35
Vitamin-Trace mineral mixture	0.35	0.35	0.35
Dl-Methionine	0.1	0.1	0.1
L-Lysine	0.1	0.1	0.1
Coccidiostat	0.1	0.1	0.1
Chemical analysis (%)			
Crude protein	22.4	19.75	18.53
ME Kcal/kg diet	2950	3095	3150
Calorie/protein ratio	131.7	156.7	170
Calcium	1.05	1.05	1.05
Phosphorus available	0.45	0.45	0.45
Lysine	1.18	1.18	1.18
Methionine	0.485	0.485	0.485
Methionine+Cystine	0.86	0.86	0.86
Tryptophan	0.25	0.25	0.25
Threonine	0.815	0.815	0.815

Supplied per Kg of diet: Vit. A, 12000 IU; Vit. D_3, 22000 IU; Vit. E, 10 mg; Vit. K_3, 2 mg; Vit. B_1, 1 mg; Vit. B_2, 4 mg; Vit. B_6, 1.5 mg; Vit. B_{12}, 10 mg; Nicotinic acid, 20 mg; Folic acid, 1 mg; Pantothenic acid, 10 mg; Biotin, 50mcg;Choline chloride, 500 mg; Copper, 10 mg; Iron, 30 mg; Manganese, 55 mg; Zinc, 50 mg; Iodine, 1 mg; Selenium, 0.1 mg; Cobalt, 0.1 mg

Blood biochemical parameters: At different ages, blood samples were taken from wing vein of 10 chicks per group using a sterile syringe. Then blood samples were centrifuged at 1500 rpm for 20 min and serum was separated. Total protein (g/dl), albumin (g/dl), globulin (g/dl), total cholesterol (mg/dl) and glucose (mg/dl) were determined using commercial kits and auto analyzer.

Liver enzymes and hormones: AST and ALT were measured by spectrophotometer using commercial available kits.

Humoral immune responses

Newcastle disease virus challenge protocol: The chickens were challenged against Newcastle disease virus in drinking water at 23 days of age as described by Atta (1990). Blood samples, about 2 ml from each chick were collected by cardiac puncture at different ages. Each blood sample was placed in the dried test tubes for 30 min at room temperature in horizontal position to allow the blood to clot and then placed vertically in the refrigerator overnight to obtain a clear serum.

Antibody titer: Both Newcastle disease virus; Hem agglutinin (HA) and Hem agglutination Inhibition titer (HI) were measured according Atta (1990). The HI titer was determined on all chicks, while the geometric mean (GM) for each group was calculated according to Steel and Torrie (1960) as follows:

GM = (X1. X2. X3 and Xn) I/n

where, X = volume of the observation and N = number of observation.

Against sheep red blood cells (SRBC's): The selected birds, 10 chicks per treatment (at different age) were injected intravenously with 0.1 ml packed SRBC mixed with 0.9 ml physiological saline (0.9% Na Cl) to measure the Humoral immune response. The SRBC were obtained in heparin solution from unrelated Texel sheep and wash three times in physiological saline. From each bird 2 ml of blood were collected to determine anti-body titers by agglutination according to Alexander *et al.* (1983). Therefore, 7 days after antigen challenge, blood samples were collected and the sera were frozen for later use in measuring the immunity (Alexander *et al.*, 1983). Abs production was measured using micro titer technique (El-Kaiaty, 1993).

Immune organs weights: At 42 days of age, relative weights of immune organs (spleen, thymus and bursa of Fabricius) as immune indexes were determined.

Statistical analysis: Data were statistically analyzed using Statistical Analysis System (SAS) software package (2004) and the significance of differences between means was tested by Duncan's multiple range test (1955). The probability values of ($p<0.05$) were considered significant.

RESULTS AND DISCUSSION

Body weight (BW/g) and body weight gain (BWG/g): Data in Table 2, showed that the averages of body weight and body weight gain were significantly ($p<0.05$) increased for broiler chicks administered with 20 and 30 mg Biomin/chicks at 2, 3, 4, 5 and 6 weeks of age than those of the control group. This improvement could be attributed to improving the absorption and utilization of nutrients through modifying the intestinal flora, especially targeting Gram-positive bacteria, which are associated with poorer health and performance of poultry. These results are agreement with those of Falaki *et al.* (2011), Naseri *et al.* (2012) and Houshmand *et al.* (2012), showed that growth performance of broiler chickens fed probiotics improved than those of the control. Similarly, the results of Mohnl *et al.* (2007) found that the synbiotic product (Biomin® Poultry Star) had a comparable potential to improve broiler performance as Avilamycin (an antibiotic growth promoter). Also, the findings of Salim (2004), showed that body weight and body weight gain of broilers fed diets containing feed additives improved significantly ($p<0.05$) as compared with control group. Also, our results on body weight were in complete agreement with that reported by Aziz Mousavi *et al.* (2015) found that body weight gain of broilers fed diets containing the synbiotic was significantly higher ($p<0.05$) than in birds fed control diet, especially at 0-2 week of age.

Feed intake and feed conversion ratio: As shown in Table 3, the findings showed that addition of the biological additives (Biomin) for broiler chicks in drinking water during first three days led to decrease weekly feed intake and improved feed utilization. Referring to feed conversion, these findings showed that feed conversion rate was lower for broilers chicks administrated with biomin than that of control birds all over experimental period.

The superiority in feed utilization and conversion in broilers received Biomin could be attributed to the effects on appetite (Nahashon *et al.*, 1994), digestive enzymes secretion (Pluske *et al.*, 1996), improve intestinal microbial balance (Fuller, 1989), inhibit the growth of either pathogenic organisms or salmonella and *E. coli* as well as improve nutrients availability and absorption (Awaad and Zouelfeker, 2001).

These results are in agreement with Ghahri *et al.* (2013), who found that feed conversion rate was lower for broilers chicks supplemented with synbiotic, prebiotic, probiotic and phosphomysin than that of control birds ($p<0.01$).

Haematological parameters: Form data presented in Table 4, no significant effect of Biomin on hemoglobin g/dl (Hb) and Hematocrit % (Ht %) for chickens at different ages. These results are in agreement with the findings of Akinleye *et al.* (2008), who found that haemotological parameters for chicks treated with Biomin insignificantly ($p>0.05$) affected after eight weeks of feeding.

Blood biochemical parameters: As shown in Table 5, the findings illustrated the averages of total protein fro treated chicks decreased significantly than that of the control at 6 weeks of age. Similar results were found by Rozbeh Fallah *et al.* (2014), found that the total protein for chicks fed 1.5 g synbiotic/kg diet decreased significantly ($p<0.05$) than those of the control group. In contrast, the results of Salim (2004), showed a significant effect of probiotics on total protein, albumen and globulin in broiler chicks.

Referring to total cholesterol, these findings showed that total cholesterol for broilers treated with biomin decreased significantly ($p<0.05$) at 2 and 4 weeks of age, while it increased at 6 weeks of age compared to control group except.

Table 2: Body weight and body weight gain of broiler chicks affected by Biomin administration (LSM±SE)

	Age/weeks						
Treatments	0	1	2	3	4	5	6
Body weight (g)							
Control (Without)	48.61±0.9	138.6±2.6	316.9±7.8^{ab}	557.82±11.83^{b}	867.3±19.6^{b}	1371.05±26.60^{C}	1854.6±34.34^{C}
T2 (20 mg Biomin)	48.5±0.9	135.1±2.6	305.5±7.4^{b}	555.8±11.1^{b}	909.6±18.5^{b}	1452.4±24.5^{b}	2025.0±32.3^{b}
T3 (30 mg Biomin)	48.29±0.9	140.2±2.5	335.1±7.4^{a}	596.0±11.08^{a}	974.9±18.36^{a}	1628.1±24.5^{a}	2237.2±32.0^{a}
Body weight gain (g)							
Control (Without)	93.3±2.2	191.4±4.9^{ab}	234.3±7.3^{b}	315.7±12.5^{b}	509.7±19.6^{b}	473.9±19.5^{b}	1806.1±37.5^{c}
T2 (20 mg Biomin)	88.7±2.0	180.0±4.52^{b}	249.5±6.8^{ab}	352.0±11.7^{ab}	532.0±18.1^{b}	579.1±18.2^{ab}	1976.9±35.6^{b}
T3 (30 mg Biomin)	92.7±2.0	203.7±4.5^{a}	261.5±7.0^{a}	378.9a±11.7^{a}	631.1±18.4^{a}	609.1±18.0^{a}	2188.7±34.9^{a}

$^{A-c}$Means with different superscripts in the same column are significantly different (p<u><</u>0.05)

*p<u><</u>0.05, **p<u><</u>0.01, ***p<u><</u>0.001, NS: p<u><</u>0.05, Sig: Significance

Table 3: Feed intake and feed conversion ratio of broiler chicks affected by Biomin administration (LSM±SE)

	Age week						
Treatments	1st week	2nd week	3rd week	4th week	5th week	6th week	Total (g)
Feed consumption (g)							
Control (Without)	175	390	496	564	1109	1204	3937.7
T2 (20 mg Biomin/chick)	133	336	415	495.5	1048	1213	3641.3
T3 (30 mg Biomin/chick)	161	358	488	538.6	1019	1192	3756
Feed conversion ratio (feed/gain)							
Control (Without)	1.93±0.04^{a}	2.10±0.05^{a}	2.01a±0.05^{a}	1.81±0.06^{a}	1.96±0.05^{a}	2.57±0.07^{a}	2.22±0.03^{a}
T2 (20 mg Biomin/chick)	1.55±0.04^{c}	1.92±0.05^{b}	1.64C±0.04^{C}	1.46±0.06^{b}	1.93±0.04^{a}	2.17±0.06^{b}	1.86±0.03^{b}
T3 (30 mg Biomin/chick)	1.78±0.04^{b}	1.82±0.05^{c}	1.88b±0.05^{b}	1.48±0.06^{b}	1.61±0.04^{b}	2.04±0.06^{c}	1.74±0.03^{c}

$^{A-c}$Means with different superscripts in the same column are significantly different (p<u><</u>0.05)

*p<u><</u>0.05, **p<u><</u>0.01, ***p<u><</u>0.001, NS: p<u><</u>0.05, Sig: Significance

Table 4: Haematological parameters of broiler chicks affected by Biomin administration (LSM±SE)

	Age/weeks			
Treatment	Hatch	2nd week	4th week	6th week
Hemoglobin (g/dl)				
Control (without)	7.06±1.01	12.28±1.08	11.40±0.53	10.82±0.79
T2 (20 mg Biomin)	7.06±1.01	9.90±1.08	11.76±0.53	10.52±0.79
T3 (30 mg Biomin)	7.06±1.01	10.92±1.08	11.66±0.53	9.74±0.79
Hematocrit (%)				
Control (without)	38.11±1.8	35.80±2.02	32.40±1.09	40.00±2.65
T2 (20 mg Biomin)	38.11±1.8	39.60±2.02	33.60±1.09	36.60±2.65
T3 (30 mg Biomin)	38.11±1.8	38.20±2.02	33.80±1.09	32.00±2.65

$^{A-c}$Means with different superscripts in the same column are significantly different (p<u><</u>0.05)

*p<u><</u>0.05, **p<u><</u>0.01, ***p<u><</u>0.001, NS: p<u><</u>0.05, Sig: Significance

The decrease in total cholesterol could be attributed to the decreased liver cholesterol concentration, which led to less cholesterol in the serum. The hypo-cholsterolaemic effect may also due to the ability of lactic acid bacteria to produce bile salt hydrolase's (BSH) enzymes, which is responsible for bile salt deconjugation (Klaver and Van der Meer, 1993). These results are in agreement with the findings of Rozbeh Fallah *et al.* (2014), found the averages of total protein for chicks fed 1.5 g/kg synbiotic (p<0.05) decreased significantly than those of the control group. Also, Beski and Al-Sardary (2015) found that the concentration of serum cholesterol and LDL of broiler chickens supplemented with symbiotic in the diet significantly (p<0.05) decreased as compared with the control group.

Kidney and Liver functions: As show in Table 6, the level of creatinine (mg %) in broiler chicks received Biomin increased significantly than those in the control group especially at 2 and 4 weeks of age. These results are in agreement with the findings of Salim (2004). In contrast, the findings showed that the averages of AST and ALT for chicks treated with Biomin at different levels (20 and 30 mg/chick) significantly (p<0.05) decreased at 4 and 6 weeks of age compared to control. These results are in agreement with the findings of Abd El-Azeem (2002), who found that broiler chicks fed Probiotics recorded significant AST, ALT enzymes activity and creatinine level.

Lymphoid organs: As presented in Table 7, no significant differences were found in treated and control chicks on spleen and thymus organs. On the other hand, Bursa fabricious weight and relative weight decreased significantly in broiler chicks received Biomin compared to control. This increase in Bursa weight for treated chicks could be reflects the improvement in bird health as a result of received Biomin in drinking water.

These results are disagreement with those of Ghahri *et al.* (2013), who found no significant differences in the absolute weight of spleen for broiler treated with Antibiotic, Probiotic, Prebiotic and Synbiotic compared to

Table 5: Effect of Biomin supplementation (M±SE) on serum biochemical parameters for broiler chicks

	Age/weeks			
Treatment	0	2	4	6
Total protein (g/dl)				
Control	3.802±0.21	3.296±0.28^{c}	3.616±0.32^{a}	4.624±0.20^{a}
T 2	3.802±0.21	4.044±0.28^{a}	2.722±0.32^{b}	3.688±0.20^{b}
T 3	3.802±0.21	3.966±0.28^{b}	3.794±0.32^{c}	4.342±0.20^{ab}
Albumin (g/dl)				
Control	1.970±0.11	1.316±0.24	1.370±0.18^{ab}	2.300±0.33
T 2	1.970±0.11	2.080±0.24	1.628±0.18^{a}	1.938±0.33
T 3	1.970±0.11	2.006±0.24	1.152±0.18^{b}	2.010±0.37
Globulin (g/dl)				
Control	1.851±0.31	1.964±0.30	2.166±0.24	2.088±0.38
T 2	1.851±0.31	1.960±0.30	2.646±0.24	2.358±0.38
T 3	1.851±0.31	1.500±0.30	2.026±0.24	2.412±0.38
Total lipids (g/dl)				
Control	0.805±0.08	0.388±0.11	0.498±0.09	0.666±0.08
T 2	0.805±0.08	0.439±0.11	0.766±0.09	0.704±0.08
T 3	0.805±0.08	0.346±0.11	0.626±0.09	0.565±0.08
Total cholesterol (mg/dl)				
Control	419.13±41.10	213.94±26.9^{a}	91.20±12.01^{a}	137.17±22.03^{b}
T 2	419.13±41.10	147.98±26.9^{ab}	72.02±12.01^{b}	156.50±22.03^{ab}
T 3	419.13±41.10	79.50±26.9^{b}	57.95±12.01^{c}	163.03±22.03^{a}
Glucose (mg/dl)				
Control	419.93±43.09	545.60±84.10	351.64±38.72	415.34±60.13
T 2	419.93±43.09	514.50±84.10	509.59±38.72	456.85±60.13
T 3	419.93±43.09	494.00±84.10	514.23±38.72	515.07±60.13

$^{a-c}$Means with different superscripts in the same column are significantly different ($p \leq 0.05$)
*$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$, NS: $p \leq 0.05$, Sig: Significance, T2: 20 mg Biomin/chick and T3: 30 mg Biomin

Table 6: Kidney and liver functions of broiler chicks affected by Biomin administration (LSM±SE)

	Age/weeks			
Group	Hatch	2nd week	4th week	6th week
Kidney functions				
Creatinine (mg %)				
Control	1.059±0.18	1.088±0.09	1.346±0.11^{a}	0.812±0.07^{ab}
T 2	1.059±0.18	1.078±0.10	1.044±0.11^{b}	0.923±0.09^{a}
T 3	1.059±0.18	0.846±0.09	1.145±0.12^{ab}	0.736±0.07^{b}
Liver functions				
AST (unit/m)				
Control	15.45±0.63	11.03±1.10	17.11±0.87^{a}	14.89±1.23^{b}
T 2	15.45±0.63	13.64±1.24	9.87±0.97^{c}	17.64±1.23^{ab}
T 3	15.45±0.63	14.24±1.12	11.20±0.87^{b}	19.10±1.37^{a}
ALT (unit/m)				
Control	8.66±1.52	7.50±2.13	9.00±3.53	11.80±3.05
T 2	8.66±1.52	9.37±2.13	11.37±3.95	13.30±3.05
T 3	8.66±1.52	7.62±2.13	11.60±3.53	12.00±3.42

$^{a-c}$Means with different superscripts in the same column are significantly different ($p \leq 0.05$)
*$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$, NS: $p \leq 0.05$, Sig: Significance

Table 7: Lymphoid organs of broiler chicks affected by Biomin administration (LSM±SE)

	At 6 weeks of age		
Traits	Control	T 2	T 3
Spleen			
Relative weight (mg/100 g BW)	167.04±35.30	192.28±35.30	217.87±35.30
Weight (g)	3.475±0.71	3.925±0.71	4.500±0.712
Thymus			
Relative weight (mg/100 g BW)	521.40±79.79	503.3±79.79	537.4±79.79
Weight (g)	11.175±1.84	10.295±1.84	11.120±1.84
Bursa			
Relative weight (mg/100 g BW)	110.93±24.122^{a}	110.93±24.122^{a}	74.93±24.122^{b}
Weight (g)	3.30±0.24^{a}	2.40±0.24^{ab}	1.68±0.24^{b}

$^{a-c}$Means with different superscripts in the same row are significantly different ($p \leq 0.05$)
$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$, NS: $p \leq 0.05$, Sig: Significance

control group. On the other hand, they added the absolute weight of bursa for treated broiler significantly affected than those in the control group. Similarly, the results of Awad *et al*. (2009), showed that the weight of thymus weight in broiler chicks supplemented with probiotic (11 g) increased significantly ($p<0.05$) than

Table 8: Antibody response to Newcastle vaccine and SRBC's of broiler chicks affected by Biomin administration (LSM±SE)

Traits and week	Control	T 2	T 3
Antibody response to Newcastle vaccine at			
0	5.00±0.32	5.00±0.32	5.00±0.32
1	4.25±0.42	5.20±0.42	5.20±0.42
2	3.80±0.58	2.00±0.58	1.80±0.58
3	0.00±0.68	0.60±0.68	0.00±0.68
4	3.60±0.11	1.80±0.11	2.80±0.11
5	5.00±0.61	6.00±0.61	5.60±0.75
6	5.60±0.75	5.80±0.74	6.80±0.75
Antibody response to SRBC's			
6	7.70±0.73	8.625±0.73	8.625±0.73
Geometric means against SRBC's			
6	207.83	394.64	394.6

A-cMeans with different superscripts in the same row are significantly different ($p \leq 0.05$)
*$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$, NS: $p \leq 0.05$, Sig: Significance

Table 9: Input-output analysis and economical efficiency of experimental study

	------- Experimental groups -------		
	T1 control	T2 (20 mg/ chick)	T3 (30 mg/ chick)
Chick price/LE	4.0	4.0	4.0
Veterinary cost/chick/LE	1.5	1.5	1.5
Feed intake/chick/Kg	3.937	3.641	3.756
Feed cost/chick (1)	14.961	13.836	14.273
New ingredient: Biomin cost/piaster *	0	1.3	1.95
Total cost/chick (a)	20.461	19.466	19.973
Marketing BW (gm)	1.854	2.025	2.237
Total revenue/chick (2) (b)	25.956	28.35	31.318
Net revenue/chick (b-a)	5.595	8.884	11.345
Economical efficiency (3)	27.34%	45.64%	56.80%
Relative E E% (4)	100%	166.93%	207.75%

1: Based upon the price of feed = 3.8 L.E. according to price (2015)
2: Based upon the price of each Kg live weight = L.E. 14.0
3: Net revenue per cost unit
4: Relative to the E.E. of the control
*New ingredient probiotics (Biomin: the price of 1 gm/0.65 L.E
This is the price of the amount of growth promoters added for one chick

those 9 and 10 g for chicks supplemented with symbiotic and control group, respectively. Also, Shoeib *et al.* (1997) reported that the bursa of probiotic-treated chickens showed an increase in the number of follicles with high plasma cell reaction in the medulla.

Immune responses and immune system capacity: The effect of Biomin treatments on antibody production against NDV in broilers from 7 to 42 day of age are presented in Table 8. On the 1st, 2nd, 3rd, 4th, 5th and 6th weeks of age, no significance difference among antibody titers of experimental groups were observed. These results are in agreement with those of Ghahri *et al.* (2013), who found no significant differences on antibody titers were found for broiler chicks at 28, 35 and 42 days of age among the prebiotic, probiotic and phosphomycin-treated birds in the entire experimental period ($p>0.05$). In contrast, the findings of Haghighi *et al.* (2006) showed that probiotics enhance the systemic antibody response to some antigens in chickens. Also, Talebi *et al.* (2008), who found that administration of a multi-strain probiotic in broiler chickens, improve the antibody responses to Newcastle disease.

With regard to immune response against sheep red blood cells as presented in Table 8, the our findings showed increase ($p<0.05$) in immune response (as Geometric Means GM) for treated broiler chicks as compared to those of the control. The beneficial effects of Probiotics on the immune system may be mediated by a direct antagonistic effect against specific groups of microorganism, resulting in a decrease in number (Hentges, 1983), or by an effect on their metabolism (Goldin and Gorbach, 1984) or by stimulating the immunity (Houshmand *et al.*, 2012). Also, Panda *et al.* (2000) showed that, the supplementation of probiotics along with injections of sheep red blood cells, revealed higher levels of anti-body productions in broiler chicks. In the other studies when the broiler diet was enriched.

Economical efficiency: Table 9, shows the data of the economical efficiency of Biomin treatments. The costs of dietary new feed stuff (20 and 30 mg Biomin /chick) were little higher than control diet. The best value of the economical efficiency was calculated for chick received Biomin at a level of (20 gm/chick) as probiotics. This was due to the improvement in feed conversion efficiency (feed/gain) for birds received Biomin as natural additives.

Conclusions and applications: Based on these data, it could be recommended to use Biomin at 20 and 30 mg/chick in drinking water as a good natural product to improve the feed utilization, immunity and Haematological parameters.

The treated broiler chicks with Biomin had significantly ($p<0.05$) increased body weight, daily weight gain as compared with control group.

Using oral Biomin administrations in drinking water at 20 and 30 mg/chick is more economical, especially for small farmers.

REFERENCES

Abd EL-Azeem, F., 2002. Digeson, Neomycin and yeast supplementation in broiler diets under Egyptian summer conditions. Egypt Poult. Sci., 22: 235-257.

Alexander, D.J., W.H. Allan and P.M. Biggs, 1983. A standard technique for hemagglutination inhibition tests for antibodies to avian infectious bronchitis virus. Vet. Rec., 113: 64.

Akinleye, S.B., E.A. Iyayi and K.D. Afolabi, 2008. The performance, haematology and carcass traits of broilers as affected by diets supplemented with or without biomin a natural growth promoter. World J. Agric. Sci., 4: 467-470.

Atta, A.M.M., 1990. A Genetical study on the White Baladi fowl. Ph. D. Thesis, Faculty of Agriculture, Cairo University, Giza, EGYPT.

Awaad, A.M.A. and S.S.A. Zouelfeker, 2001. Project report: effects of Probiotics and Combination of *E. coli* Infections in Broiler Chickens. Cairo University, Faculty of Veterinary Medicine, Department of Poultry Diseases, Giza, Egypt.

Awad, W.A., K. Ghareeb, S. Nitsch, S. Pasteiner, Abdel S. Raheem and J. Bohm, 2008. Effects of dietary inclusion of prebiotic, probiotic and synbiotic on the intestinal glucose absorption of broiler Chickens. Int. J. Poult. Sci., 7: 2205-2216.

Awad, W.A., K. Ghareeb, S. Abdel-Raheem and J. Bohm, 2009. Effects of dietary inclusion of probiotic and synbiotic on growth performance, organ weights and intestinal histomorphology of broiler chickens. Poult. Sci., 88: 49-55.

Aziz Mousavi, S.M.A., A. Seidavi, M. Dadashbeiki, Kilonzo-A. Nthenge, S.N. Nahashon, V. Lauaddio and V. Tufarelli, 2015. Effect of a synbiotic (Biomin® IMBO) on growth performance traits of broiler chickens. Eur. Poult. Sci., 79: 1612-9199, © Verlag Eugen Ulmer, Stuttgart.

Beski, S.S.M. and S.Y.T. Al-Sardary, 2015. Effects of Dietary Supplementation of Probiotic and Synbiotic on Broiler Chickens Hematology and Intestinal Integrity. Int. J. Poult. Sci., 14: 31-36.

Castanon, J.I., 2007. History of the Use of Antibiotics as Growth Promoters in European Poultry Feeds. Poult. Sci., 86: 2466-2471.

Chichlowski, M., W.J. Croom, F.W. Edens, B.W. MacBride, R. Qiu, C.C. Chiang, L.R. Daniel, G.B. Havenstein and M.D. Koci, 2007. Microarchitecture and spatial relationship between bacteria and ileal, cecal and colonic epithelium in chicks fed a direct-fed microbial, PrimaLac and salinomycin. Poult. Sci., 86: 1121-1132.

Duncan, D.B., 1955. Multiple range and multiple F tests. Biomet., 11: 1-42.

El-Kaiaty, A.M., 1993. Immunogenetic studies in local breeds of Chickens. Ph.D. Thesis, Faculty of Agriculture, Cairo University, Giza, EGYPT. (Poultry Physiology).

European Commission, 2003. Regulation (EC) No. 1831/2003 of the European Parliament and of the Council of 22 September 2003 on additives for use in animal nutrition. Official J. Eur. Union L., 268: 29-43.

Erfani Majd, N., M. Mayahi and A. Sadeghi Moghadam, 2014. The effect of alphamune and biomin on histomorphological structure of small intestine and caecal tonsil lymphoid tissue in broiler chicken. Iranian J. Vet. Res., 46: 30-35.

Falaki, M., M. Shams Shargh, B. Dastar and S. Zerehdaran, 2011. Effect of different levels of probiotic and prebiotic on performance and carcass characteristics of broiler chickens. J. Anim. Vet. Adv., 10: 378-384.

Fuller, R., 1989. Probiotics in man and animals. J. Applied Bacteriol., 66: 365-378.

Goldin, B.R. and S.I. Gorbach, 1984. The effect of milk and lactobacillus feeding on human intestinal bacterial enzyme activity. Am. J. Clin. Nutr., 39: 756-761.

Ghahri, Hasan, Tohid Toloei and Behzad Soleimani 2013. Efficacy of Antibiotic, Probiotic, Prebiotic and Synbiotic on Growth Performance, Organ Weights, Intestinal Histomorphology and Immune Response in Broiler Chickens.Ghahri *et al*., Global J. Anim. Scient. Res., 1: 25-41.

Haghighi, H.R., J. Gong, C.L. Gyles, M.A. Hayes, H. Zohu, B. Sanei, J.R. Chambers and S. Sharif, 2006. Probiotics stimulate production of natural antibodies in chickens. Clin. and Vaccine Immunol., 139: 975-980.

Houshmand, M., K. Azhar, I. Zulkifli, M.H. Bejo and A. Kamyab, 2012. Effects of non-antibiotic feed additives on performance, immunity and intestinalmorphology of broilers fed different levels of protein. S. Afr. J. Anim. Sci., 2: 22-32.

Hentges, D.J., 1983. Role of intestinal micro flora in host defense against infection in human intestinal microflora in health and diseases. Ed. Hentges Ch., 14: 311-331.

Klaver, F.A.M. and R. Van der Meer, 1993. The assumed assimilation of cholesterol by Lactobacilli and Bifid-bacterium bifidium is due to their bile salt-deconjugation activity. Applied and Environ. Microb., 59: 1120-1124.

Liong, M.T. and N.P. Shah, 2006. Effects of a Lactobacillus Casei symbiotic on serum Lipoprotein, intestinal microflora and organic acid in rats. J. Dairy Sci., 89: 1390-1399.

Montes, A.J. and D.G. Pugh, 1993. The use of probiotics in food-animal practice. Vet. Med., 88: 282- 288.

Maff, 1984. Ministry of Agriculture Fisheries and Food. Manual of Veterinary Investigation Techniques. Volume 2. Reference Book 390. Third Edition. Edited by Davies E.T., Benson, J.A., Bicknel, S.R., Grey, D.E.; Hewitt, S.G., Lloyd, Morrison, J.R.A., Ostler, D.C., Pepin, G.A. and Purvis, C.M. MAFF/ADASS.

Mohammadamin, O.G. and T.S. Qubih, 2011. Histopathology of virulent Newcastle disease virus in immune broiler chickens treated with IMBO®. Iraqi J. Vet. Sci., 25: 9-13.

Mohnl, M., 2006. Benefits from using biomin c-x and biomin imbo in poultry production. Biomin Newsletter, 4: 37.

Mohnl, M., Y. Acosta Aragon, A. Acosta Ojeda, B. Rodriguez Sanchez and S. Pasteiner, 2007. Effect of synbiotic feed additive in comparison to antibiotic growth promoter on performance and health status of broilers. Poult. Sci., 86: 217.

Mustafa, N.G., 2009. Effects of different doses of probiotic (biomin)® on some hematological and biochemical parameters in chicken. J. Edu. and Sci., 4: 45-55.

Nahashon, S.N., H.S. Nakaue and L.W. Mirosh, 1994. Production variables and nutrient retention in Single Comb White Leghorn laying pullets fed diets supplemented with direct-fed microbials. Poult. Sci., 73: 1699-1711.

Naseri Alavi, S.A., A. Zakeri, B. Kamrani and Y. Pourakbari, 2012. Effect of Prebiotics, Probiotics, Acidfire, Growth Promoter Antibiotics and Synbiotic on Humural Immunity of Broiler Chickens. Glob Vet., 8: 612-617.

NRC, 1994. Nutrient requirements of poultry. 9th rev. Ed. Na-tional Academy Press, Washington D.C. USA.

Panda, A.K., M.R. Reddy, S.V. Ramarao and N.K. Praharaj, 2000. Effect of dietary supplementation of probi-otic on performance and immune response of layers in decline phase of production. Indian J. Poult. Sci., 3: 102-104.

Perdigon, G., S. Alvarez, M. Rachid, G. Aguero and N. Gobbato, 1995. Immune system stimulation by Probiotics. J. Dairy Sci., 78: 1597-1606.

Periæ, L., D. Zikic and M. Lukic, 2009. Application of Alternative Growth Promoters in Broiler Production. Biotechnol. in Anim. Husbandry, 25: 387-397.

Plail, R., 2006. The Innovative power of probiotics. Poult. Int., pp: 34-36.

Pluske, J.R., M.J. Tompson, C.S. Atwood, P.H. Bird, I.H. Williams and P.E. Hartmann, 1996. Maintenance of villus height and crypt depth and enhancement of disaccharide digestion and monosaccharide absorption, in piglets fed on cows' whole milk after weaning. Br. J. Nutr., 76: 409-422.

Roofchaee, A., I. Mehrdad, M.A. Ebrahimzadeh and M.R. Akbari, 2011. Effect of Dietary Oregano (*Origanum vulgare* L.) Essential Oil on Growth Performance, Cecal Microflora and Serum Antioxidant Activity of Broiler Chickens. Afr. J. Biotechnol., 10: 6177-6183.

Rozbeh Fallah, Sayed Sadra, Ale Saheb Fosoul and Hasan, Rezaei, 2014. Effect of Synbiotic on Performance and Serum Biochemical Parameters of Ostrich Chicks. J. Farm Anim. Nutr. and Physiol., 1: 51-56.

Rodrigues, T.A., C. Sartor, S.E. Higgins, A.D. Wolfenden, L.R. Bielke, C.M. Pixley, L. Sutton, G. Tellez and M. Hargis, 2005. Effect of Aspergillus meal prebiotic (fermacto) on performance of broiler chickens in the starter phase and fed low protein diets. J. Appl. Poult. Res., 14: 665-669.

Salim, I.H., 2004. Effect of dietary protein and some feed additives on broiler performance. M.Sci. Thesis, Cairo University.

Samli, H.E., N. Senkoylu, F. Koc, M. Kanter and A. Agma, 2007. Effects of *Enterococcus faecium* and dried whey on broiler performance, gut histomorphology and microbiota. Arch. Anim. Nutr., 61: 42-49.

SAS, 2004. SAS Procedure Guide. Release 6.03 Edition. SAS Institute Inc., Cary, Nc U.S.A.

Shoeib, H.K., A.N. Sayed, S.A. Sotohy and S.K. Abdel Ghaffar, 1997. Response of broiler chicks to probiotic (pronifer) supplementation. Assiut. Vet. Med. J., 36: 103-116.

Steel, R. and J.H. Torrie, 1960. Principles and Procedures of Statistics. 1st ed. McGraw-Hill Book Co. Inc. New York.

Talebi, A., B. Amirzadeh, B. Mokhtari and H. Gahri, 2008. Effects of a multi-strain probiotic (PrimaLac) onperformance and antibody responses to Newcastle disease virus and infectious bursal disease virus vaccination in broiler chickens. Avian Pathol., 37: 509-512.