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Evaluation of Bio-Mos® as a Feed Additive on Laying Performance and Egg Quality of Laying Hens

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ABSTRACT

This study was performed to investigate the effects of supplementation of Bio-Mos® on laying performance, egg quality and blood parameters during the laying period (22-36 wks of age). 22 wks old, sixteen laying Lohmann were randomly distributed into four dietary treatments of 15 hens each in three replicates. Diets were formulated containing 0.0% (control), 0.1, 0.3 and 0.5% Bio-Mos. The experimental results indicated that the use of Bio-Mos® in the layer diet decreased significantly (P>0.05) the final body weight, weight gain and feed conversion ratio (FCR) in comparison to the control diet. While, the laying rate and egg mass improved significantly with increased Bio-Mos level compared to control diet. Average egg weight and feed intake were not affected significantly by the addition of Bio-Mos levels in diet. Mortality rate decreased with increased level of Bio-Mos in layer diet. The serum lysozyme and sheep red blood cells (SRBC) increased significantly by Bio-Mos supplementation in the diets. The egg quality traits were affected significantly with addition Bio-Mos in the layer diet. The results indicated that Bio-Mos supplementation at 0.5% level in laying hens diets can be a good practice to increase laying performance, immune response and some of the egg quality traits.

Key words: Egg performance, Bio-Mos®, mannan oligosaccharide, feed utilization, innate immunity and A. hydrophila, lysozyme

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INTRODUCTION

There isa need to look for viable alternatives that could enhance the natural defense mechanisms of animals and reduce the massive use of antibiotics (Verstegen and Williams, 2002). One way is to use specific feed additives to favorably affect animal performance and welfare, particularly through the modulation of the gut microbiota which plays a critical role in maintaining host health (Tuohy *et al.*, 2005). A balanced gut microbiota constitutes an efficient barrier against pathogen colonization, produces metabolic substrates (e.g. vitamins and short-chain fatty acids) and stimulates the immune system in a non-inflammatory manner. In this context, prebiotics could be possible solutions. The main effects of these feed additives are improved resistance to pathogenic bacteria colonization and enhanced host mucosa immunity (Choct, 2009; Williams *et al.*, 2001). Prebiotics alter the intestinal microbes and immune system to reduce colonization by the pathogens in certain conditions (Hajati and Rezaei, 2010). Prebiotics are nondigestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon, thus improving the host's microbial balance (Gibson and Roberfroid, 1995). Prebiotics have the advantage, compared with probiotics, that bacteria are stimulated which are normally present in the GIT of that individual animal and therefore already adapted to that environment (Snel *et al.*, 2002). A positive effect of the prebiotics on some eggshell quality parameters in laying hens has been reported (Swiatkiecz *et al.*, 2010). Scholz-Ahrens *et al.* (2007) reported that the mechanism of the positive effect of increased production of short-chain fatty acids. One of the most important compounds of feeds for farm animals is the protein source. Pathogenic bacteria increase the breakdown of proteins to nitrogen and reduce the efficiency of dietary protein (Mikulec *et al.*, 1999).

Bio-Mos® has been derived from a specific strain of *Saccharomyces cerevisiae* and composed of the outer cell wall of the bacteria. Bio-Mos® is rich in mannan oligosaccharide, which promotes growth performance, improves feed efficiency and modulates the immune response (Staykov *et al.*, 2007; Torrecillas *et al.*, 2007). Prebiotics additives may have a positive impact on mineral metabolism in poultry (Swiatkiewicz and Arczewska-wlosek, 2012). Therefore, the objective of this study was to evaluate the effects of adding commercial Bio-Mos® to laying hen diets on performance, egg quality traits and blood biochemical parameters.

MATERIALS AND METHODS

Experimental birds and management of the flock

Birds and diet

This study was performed at Poultry Experimental Station, Animal Production Department, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt. A total number of 60 Lohmann hens having 22 weeks age. The experiment was lasted for 14 weeks of age (from 22 to 36 weeks of age). Birds were randomly distributed into four experimental groups with three replicates, 5 hens for each. Each group was housed in separate pens in battery cages in open sided cages (45 -45 cm with a height of 45 cm). Average initial weight of hens was 1578±7 g. The average temperature and humidity were 35±5.0^{o}C and 50 ±10.0% respectively. A photoperiod of 16L: 8D was performed during experimental period. Feeds and water were offered *ad libitum* for chicks along the experimental period. The conditions of housing and management of birds for all groups were similar during the experimental period and all birds were healthy and clinically free from disease. The four experimental diets contained 0.0, 0.1, 0.3 and 0.5% of Bio-Mos® (Valu vit Company, Cairo, Egypt). The proximate chemical composition of the Bio-Mos® is given in Table 1. Bio-Mos® containing mannan oligosaccharide as active principle and naturally derived from the outer cell walls of *Saccharomyces cerevisiae* yeast. The diets were calculated based on NRC (1994) analytical values of feedstuffs. After formulating the diets, chemical analysis for crude protein (CP), ash, ether extracts (EE) and crud fibers (CF) of diets were determined using methods of (AOAC, 1990). The formulations and chemical composition of the experimental diets are given in Table 2.

Productive performance

Body weights of laying hens were recorded at the start of experimental period at 22 weeks of age. Egg production was recorded for 98 days of each replicate; egg number and egg mass were recorded daily per replicate. Feed intake, laying rate, and feed conversion ratio were measured for replicate (5 hens) weekly. Final body weights, body weight gain and mortality rate of laying hens were recorded at the end of experimental period.

Egg quality traits

A total number of 36 fresh eggs were taken from each replicate (3egg/each replicate) at the end of the experiment for measuring the egg quality. Eggs were weighed individually, then the eggs were broken at its equator and the internal contents were taken for subsequent measurements. The eggshells were then washed carefully until all albumin residues were apparently discarded. The shells with inner membranes were air dried for 24 h and shell weight was recorded. The thickness of the shell was measured at three points around the equatorial line of the egg without membrane by a micrometer to the nearest 0.01 millimeter. Shell thickness was recorded as the average of the three measurements. The yolk was separated from the albumen of the internal contents of the former egg, yolk, albumen and shell were weighed separately to the nearest 0.1g. The yolk color was measured with the use of DSM Roche yolk color fan.

Table 1: Proximate chemical analysis of Bio-Mos on dry matter (DM basis)

Items (%	Bio-Mos®
Dry matter	95.2
Crude protein	29.59
Total lipids	5.31
Ash.	7.97
NFE*.	51.91
Crude fiber	5.22

*Nitrogen-free extract (NFE) = 100 – (protein+ lipid + ash+ fiber).

Table 2: Formulation and diet composition of laying hens

Ingredients	(Control) 0.0%	(T1) 0.1%	(T2) 0.3%	(T3) 0.5%
Ground yellow corn (8.5% CP)	64.50	64.40	64.20	64.00
Soybean meal (44% CP)	13.75	13.75	13.75	13.75
Corn gluten meal (60% CP)	10.00	10.00	10.00	10.00
L-Lysine HCl (%)	0.21	0.21	0.21	0.21
DL-Methionine (%)	0.10	0.10	0.10	0.10
*Premix (%)	0.30	0.30	0.30	0.30
Sodium chloride (%)	0.30	0.30	0.30	0.30
Di-Calcium phosphate (%)	2.14	2.14	2.14	2.14
Calcium carbonate (%)	8.70	8.70	8.70	8.70
Bio-Mos®	0.0	0.1	0.3	0.5
Total (kg)	100	100	100	100
Calculated				
Crude protein (%)	18.04	18.06	18.09	18.14
ME (kcal /kg diet)	2838	2835	2830	2824
Lysine (%)	0.84	0.84	0.84	0.84
Methionine + cystein (%)	0.77	0.77	0.77	0.77
Methionine (%)	0.44	0.44	0.44	0.44
Available phosphorus (%)	0.50	0.50	0.50	0.50
Calcium (%)	3.83	3.83	3.83	3.83
Crude fiber (%)	2.46	2.49	2.50	2.52
CP (%)	18.00	18.03	18.05	18.09
EE (%)	4.01	4.01	4.01	4.01
Ash (%)	4.63	4.63	4.63	4.63
CF (%)	2.50	2.52	2.55	2.60

*Each 2.5 kg of laying premix contained Vit A 10000000 I.U, Vit D3 2000000 I.U, Vit E 10000 mg, Vit K3 1000 mg, Vit $B_1$1000 mg, B_2 5000 mg, $B_6$1500 mg, B_{12} 10000 mg, Nicotinic acid 30000 mg, Pantothenic acid 10000 mg, folueic acid 1000 mg, Biotin 250 mg, Choline Chloride 50% 250000 mg, Fe 30000, Cu 4000 mg, Zn 50000 mg, Manganese 60000 mg, Iodine 1300 mg, Selenium 100 mg, Cobalt 100 mg Carrier Q.S up to 2.5kg

Blood measurements

At the end of experiment, three birds per treatment were taken to blood serum sample. For experimental immunization, antibody against Sheep Red Blood Cells (SRBC) was measured using the method designed by Trout *et al.* (1996). Serum lysozyme activity was determined by spectrophotometer (Spectronic 20 D, Milton Roy Company) using specific kits (BIO ADWIC) based on the calibration curve and the extinction measured according to Schaperclaus *et al.* (1992).

Statistical analysis

Data were subjected to analysis of variance using the General Linear Models. Analysis of covariance was used for final body weight, body weight gain, laying rate, average egg weight, egg mass and feed conversion ratio. SPSS software program package (SPSS® 1998) was used for statistical analysis. Significant differences among means were determined by Duncan's multiple range test (Duncan, 1955) at 5% level of significant.

RESULTS AND DISCUSSION

Results presented in Table 3 showed that differences in average values of initial body weight among the experimental groups were insignificant, indicating the random distribution of individuals into the experimental groups. The analysis of variance showed that final body weight decreased (P 0.05) in Bio-Mos fed groups, however, differences among the treatment groups were insignificant . Similary body weight gain decreased significantly (P<0.05) compared to the control group, however, differences among the treatments levels were insignificant. Egg mass increased significantly with increasing Bio-Mos levels in 0.3 and 0.5% fed groups. These results may be attributed to the positive effect of MOS which reduces incidence of disease organisms, greater feed consumption and accelerated activities of digestive system (Suzer *et al.,* 2008). The analysis of variance indicated that feed intake and average egg weight were not affected by treatment. Feed conversion ratio improvement with increasing Bio-Mos levels compared with control group. In this regard, Bio-Mos may operate by producing antibiotic substances and subsequently inhibiting harmful bacteria, altering microbial metabolism and decrease intestinal pH (Abdel-Nasser, 2004). The mortality percentage was higher for control group compared to other treatments. These results suggested that Bio-Mos activate the immune system of the hens and it became resistance to pathogenic bacteria. This result may be due to the positive effect of mannan oligosaccharide on health and reduced mortality associated with infection by pathogens (Krol, 2011).

Results of egg quality traits are presented in Table 4. The result revealed that egg weight, yolk weight, shell weight and albumen height (mm) increased significantly by increasing Bio-Mos levels. Albumen weight and yolk color were not affected significantly in all treatments. Shell thickness was significantly (P 0.05) lower for control group compared to group fed 0.5% Bio-Mos. There is strong correlation between increase absorption of minerals and fermentation of nondigestible oligosaccharides in the large intestine (Scholz-Ahrens *et al.,* 2007). Thus, it can be suggested that the improvement in egg shell quality in this study might be due to the increased mineral absorption. General results from (Table 4) addition of Bio-Mos to the diet of laying hens improved egg production, feed conversion ratio, egg weight, yolk weight and egg shell thickness.

Table 5 shows the effect of the experimental diets on serum lysozyme and serum antibody titer against SRBC. The results obtained indicated that above mentioned traits increased significantly with increasing Bio-Mos level compared to control group (0.0%).

Table 5 shows the effect of the experimental diets on serum lysozyme and antibody titer against SRBC. The results obtained indicated that above mentioned traits increased significantly with increasing Bio-Mos level compared to control group. This result was due to the structural mannan oligosaccharide, which improved hen's resistance against infection. Lysozyme is important part of humoral immunity that may effectively control the invasion of microorganisms (Krol, 2011). Torrecillas et al. (2007) found a positive correlation between lysozyme level in blood of European sea bass (*Dicentrarchus labrax*) and inclusion levels of dietary Bio-Mos®. Portions of the cell wall structure of the yeast organism, Saccharomyces contained in MOS has been shown to elicit powerful antigenic properties (Ferket et al., 2002).

Table 3: Effect of different levels of Bio-Mos on performance of Lohmann laying hens from 22 to 36 weeks of age (means±SE)

Treatments	0.0%	0.1%	0.3%	0.5%
Initial body weight (g)	1575±2.88	1571.66±2.72	1578.67±2.88	1575.65±3.48
Final body weight (g)	1887±7.23^{a}	1871.33±3.52^{b}	1880.00±2.51^{ab}	1870.66±2.33^{b}
Body weight gain (g)	312±4.35^{a}	299.66±1.85^{b}	301.33±2.60^{b}	295±3.60^{b}
Laying rate (%)	71.59±1.92^{b}	73.57±1.80^{b}	79.98±1.1^{a}	81.74±1.42^{a}
Feed intake (kg)	9.40±0.24	9.43±0.15	9.71±0.13	9.64±0.28
Average egg weight (g)	51.79±0.92	52.70±1.25	54.15±0.6	54.68±0.69
Egg mass (g)	3.71±0.16^{b}	3.87±0.09^{b}	4.33±0.05^{a}	4.47±0.04^{a}
Feed conversion ratio	2.54±0.14^{a}	2.43±0.07^{ab}	2.24 ±0.02^{b}	2.15±0.04^{b}
Mortality (%)	13.33	6.66	0	0

$^{a, b, c}$Means the same rows have the different superscript are significantly different (P<0.05)

Table 4: Effect of different levels of Bio-Mos on egg quality of Lohmann laying hens from 22 to 36 weeks of age (means±SE)

	0.0%	0.1%	0.3%	0.5%
Egg weight (g)	51.16±0.83^{b}	52.42±0.27^{b}	53.45±0.91^{b}	57.23±1.53^{a}
Yolk weight (g)	13.01±0.16^{b}	13.03±0.26^{b}	13.13±0.54^{b}	15.01±0.50^{a}
Shell weight (g)	5.00 ±0.03^{b}	5.10±0.10^{b}	5.19±0.06^{b}	5.71±0.20^{a}
Albumen weight (g)	33.05±0.97	34.29±0.63	35.13±1.23	36.50±1.80
Shell thickness (mm)	0.39±0.01^{b}	0.41±0.01^{ab}	0.42±0.01^{ab}	0.44±0.01^{a}
Yolk color	6.33±0.33	6.33±0.33	6.33±0.33	7.0±0.57
Albumen height (mm)	6.38±0.04^{b}	6.24±0.03^{b}	6.46±0.02^{b}	6.78±0.13^{a}

$^{a, b, c}$Means the same rows have the different superscript are significantly different (P<0.05)

Table 5: Effect of different levels of Bio-Mos on lysozyme activity of serum and antibody titer against [1]SRBC (means±SE)

Parameters	Bio-Mos levels			
	0.0%	0.1%	0.3%	0.5%
Lysozyme (μg/ml)	2.80 ±0.15^{b}	3.12±0.15^{b}	3.77±0.18^{a}	4.03±0.04^{a}
Antibody titer against SRBC	6.26 ±0.16^{b}	6.28±0.9^{b}	7.57±0.7^{b}	7.93±0.17^{a}

$^{a, b, c}$Means the same rows have the different superscript are significantly different (P<0.05); SRBC: Sheep Red Blood Cells

Conclusion

In general results of this study may lead us to conclude that addition of Bio-Mos® at 0.5% level in laying diets is worthy for obtaining better laying performance results and higher immune response.

REFERENCES

Abdel-Nasser KHMB, 2004. Studies on the effect of some feed additives on the growth, health and immunity of Nile Tilapia, MVSc Faculty of Veterinary Medicine, Cairo University.

Association of official analytical chemists AOAC, 1990. Official methods of analysis 15th Ed., Published by Assoc. Office. Anal Chem, Washington DC, USA.

Choct M, 2009. Managing gut health through nutrition. Br Poultry Science, 50: 9-15.

Duncan DB, 1955. Multiple range and multiple F-test. Biometrics, 11:1-42.

Ferket PR, CW Parks and JL Grimes, 2002. Benefits of dietary antibiotic and mannan oligosaccharide supplementation for poultry. Department of Poultry Science, North Carolina State University, Box 7608, Raleigh, NC 27695-7608.

Gibson GR and MB Roberfroid, 1995. Dietary modulation of human colonic microbiota: Introducing the concept of prebiotic. J Nutr, 125: 1401-1412.

Hajati H and M Rezaei, 2010. The application of prebiotics in poultry production. Inter J Poult Sci, 9: 298-304.

Krol B, 2011. Effect of mannanoligosaccharides, inulin and yeast nucleotides added to calf milk replacers on rumen microflora, level of serum immunoglobulin and health condition of calves. EJPAU, 14, 2: 78-89.

Mikulec Z, V Serman, N Mas and Z Lukac, 1999. Effect of probiotic on production results of fattened chickens fed different quantities of protein. Vet Arhiv, 69: 199-209.

National Resarch Concil, 1994. Nutrient Requirements of Poultry. 9th Edn, National Academy Press, Washington, DC.

Schaperclaus W, H Kulow and K Schreckenback, 1992. Fish Disease Vol. I AA Balkema / Rotterdam.

Scholz-Ahrens KE, P Ade, B Marten, P Weber, W Timm, Y Asil, CC Glüer, J Schrezenmeir, 2007. Prebiotics, probiotics and synbiotics affect mineral absorption, bone mineral content, and bone structure. J Nutrition, 137: 838-846.

Snel J, HJM Harmsen, PWJJ Van De Wielen, and BA Williams, 2002. Dietary strategies to influence the gastrointestinal microflora of young animals, and its potential to improve intestinal health, in: BLOK, MC (Ed.) Nutrition and health on the gastrointestinal tract, 37-69 (Wageningen Academic Publishers, Wageningen, Netherlands).

SPSS for Windows S, Chicago, IL SPSS®. Computer Software 10.00, 1998. SPSS Inc., Headqurters. Wacker Drive, Chicago, Illinois 60606, USA. 233PP.

Staykov Y, P Spring, and S Denev, 2007. Influence of dietary Bio-Mos on growth, survival and immune status of rainbow trout (*Salmo gairdneri irideus G.)* and common carp (*Cyprinus carpio L*.). Aquaculture International, 15: 333-343.

Suzer C, D Coban, HO Kamaci, S Saka, K Firat, O Otgucuoglu, and H Kucuksari, 2008. *Lactobacillus* spp. Bacteria as Probiotics in Gilthead Seabream *Sparus aurata* Larvae: Effects on Growth Performance and Digestive Enzyme activities. Aquaculture, 280: 140-145.

Swiatkiecz S, J Koreleski, and A Arczewska, 2010. Laying performance and eggshell quality in laying hens fed diets supplemented with prebiotics and organic acids. Czech J Anim Sci, 55: 294-304.

Swiatkiewicz S and A Arczewska-wlosek, 2012. Prebiotic fructans and organic acids as feed additives improving mineral availability. World's Poult Sci J, 68: 269-279.

Torrecillas S, A Makol, M Jcaballero, D Montero, L Robaina, F Real, J Sweetman, L Tort, and MS Izquierdo, 2007. Immune stimulation and improved infection resistance in European sea bass (*Dicentrarchus labrax*) fed mannan oligosaccharides. Fish Shellfish Immunol, 23: 969-981.

Trout JM, MM Mashaly and HS Siegel, 1996. Changes in blood and spleen lymphocyte populations following antigen challenge in immature male chickens. Br Poult Sci, 37: 819-827.

Tuohy KM, GCM Rouzaud, WM Bruck and GR Gibson, 2005. Modulation of the human gut microflora towards improved health using prebiotics-assessment of efficacy. Current Pharmaceutical Design, 11: 75-90.

Verstegen MWA and BA Williams, 2002. Alternatives to the use of antibiotics as growth promoters for monogastric animals. Anim Bio, 13: 113-127.

Williams BA, MWA Verstegen and S Tamminga, 2001. Fermentation in the large intestine of single-stomached animals and its relationship to animal health. Nut Res Rev, 14: 207-227.