

Effect of Probiotic , Prebiotic and Antibiotic on Growth Performance, Blood Parameters and Immunocompetence in Broiler Chickens

Walaa. M. Abd-El Razik, Mahmoud. F.A.El-Gamal

And Magdy E.H. El-Kholy

Dept. of Nutrition And Clinical Nutrition, Fac. Of Vet.Med.Zag.Univ., Zag., Egypt.

ABSTRACT

This work was conducted to evaluate the effect of dietary supplementation of probiotic, prebiotic in comparison to growth promoting antibiotics, on growth performance, serum biochemical parameters and immune response of broiler chickens . One hundred and twenty, one day -old Hubbard broiler chickens were used in this experiment. The chicks were fed on starter diet and grower finisher diet each for 3 weeks. The diet was supplemented by probiotic, prebiotic and antibiotic as growth promoting factors. Body weight and feed intake were determined and body weight gain and feed conversion ratio were calculated. At the end of the experiment blood samples were collected and the obtained sera were used for determination of total protein, albumen, globulin, total cholesterol, triglycerides and haemoglobin percent. Haemagglutination inhibition (HI) antibody titer against Newcastle disease was carried out.

The results revealed that probiotic as well as prebiotic during the whole experiment period significantly improved body weight, body weight gain and feed conversion ratio. Chicks feed probiotic supplementation showed increased serum total protein and globulin and decreased total cholesterol and triglycerides. Both probiotic and prebiotic increased HI titer in broiler chickens.

It can be concluded that probiotic or prebiotic supplementation to broiler diets improve the growth performance parameters, biochemical parameters as a natural feed products with immuno- enhancing properties.

INTRODUCTION

Poultry are nowadays raised under intensive production systems in densely populated flocks to achieve high levels of economic efficiency. During this process chickens may get stress from a number of factors such as over crowding, unfavourable ambient medium, and vaccination.

The dietary use of feed additives feeding is gaining momentum in broiler to counter act and minimize the stresses (1-3). Probiotics and prebiotics are types of the approaches that have a potential to reduce chances of infections in poultry and subsequent contamination of poultry products. Probiotic foods can be said functional as it contains a component that affect a number of functions in the body in a targeted way so as to have a positive effect on health (4). The value of probiotics in promoting growth and feed efficiency in poultry has been well documented (5,6). Probiotics of the intestinal

microflora in poultry, especially with lactobacillus species, showed beneficial effects on resistance to infectious agents as E.coli (7) Salmonella sp. (8) campylobacter sp. (9) and recently, Eimeria acervulina (10). Proposed mechanism of pathogen inhibition include competition for nutrients, production of antimicrobial conditions and compounds (Volatile fatty acid, low PH and bacteriocins) and stimulation of immune system (11). Recently, beside probiotics nutritionists are interested in compounds that may serve as possible feed additive " Bio-Mos". a mannan oligosaccharide derived from the cell wall of the yeast *saccharomyces cerevisiae*, has shown promise in suppressing enteric pathogens, modulating the immune response, and improving the integrity of the intestinal mucosa in chickens & turkeys (12-15). Hence an attempt was conducted to study the effect of probiotic (Primalac), prebiotic (Bio.Mos) in broiler diets in comparison to commonly used growth promoting antibiotics.

MATERIAL AND METHODS

One hundred and twenty, one day old unsexed broiler chicks were used in this study. The birds were weighed and randomly divided into four equal groups each contain thirty chicks then each group was divided into 3 equal subgroups. Ten chicks were allocated into each subgroup. All the chicks were vaccinated against Newcastle and Gumboro diseases (HitchenerB1 at 7 days of ages and Lasota at 17-27-37 days of age. The birds were housed in separated clean pens and kept under continuous lighting system with suitable temperature till the end of the experiment. The groups were assigned to the basal diet which formulated to meet the nutrient requirements set by NRC (16) during starter period (0-3wks) and grower finisher period (3-6wks). The basal diet was supplemented by one of the three dietary treatment as shown in experimental protocol Table 1. Chickens were weighed weekly to determine body weight, body weight gain, also amount of feed consumption and feed conversion ratio were calculated. For biochemical studies blood samples were collected from each group at one day of age to determine maternal immunity for Newcastle disease (HI) (17). Then at 8,22 &

42 days serum was obtained from the blood samples for the biochemical assays as total serum cholesterol concentration (18), serum total protein (19), serum albumin (20), serum globulin by subtracting the obtained albumin level from the total protein (21), serum triglyceride concentration (22). The biochemical tests were performed using test kits which are (total protein, albumin and total lipid) from Diamond- Egypt and (total cholesterol) from Spain react-Spain.

Heamagglutination inhibition test (HI) was carried out to determine the immune response titer (17). Statistical analysis of data was carried out using liner model of SAS statistical Analysis System package (23).

Table 1. Experimental protocol

Group	Treatment
1	Basal diet
2	Basal diet + (antibiotic) Virginamycin (10mg/ kg diet)
3	Basal diet + (probiotic) Primalac (1gm/ kg diet)
4	Basal diet + (prebiotic) Bio-mos (1gm / kg diet)

Table 2 . Experimental diet.

Ingredients %	Starter diet (0-3 weeks)	Grower finisher diet (3-6 weeks)
Ground yellow corn	55	60
Soybean meal (44%)	35	31
Fish meal (65%)	4	2.5
Vegetable oils	2	4
Calcium carbonate	1.5	1.6
Dicalcium phosphate	1.5	-
Premix*	0.5	0.25
DL-Methionine	0.3	0.1
Lysine	0.05	0.1
Salt	0.15	0.45
Calculated analysis		
Crude protein (%)	22.6	20.14
ME Kcal/Kg diet	2981	3128

*premix: Each 2.5 Kg contain Vit. A (1000000 IU), Vit. D3 (2000000 IU), Vit .E (10000mg), Vit. K3 (1000 mg), Vit .B1 (1000mg), Vit. B2 (5000mg), Vit. B6 (1500mg), pantothenic acid (10000mg), Vit. B12 (10mg), Niacin (30000mg) , Folic acid (1000mg), Biotin(50mg), Fe (30000mg), Mn (60000mg), Cu (4000 mg) , I (300mg), Co (100mg), Se (100mg) and Zn (50000mg).

RESULTS AND DISCUSSION

The results of this study indicated that all dietary treatment groups had a significant increased body weight. When compared with control group Table 3 while, body weight gain was significantly improved in group 3,4 in comparison to group 1 and 2 along the experimental period. Probiotics were the most effective growth promoter, and probiotic feed chickens had more weight than other groups (24,25) while, it has been recorded that supplementation of probiotics has no effect on the performance of broiler chickens (26,27).

Feed conversion ratio as affected by dietary treatment is the subjected of controversy, we could not detect any differences in feed conversion ratio in the starter period, while in the grower finisher period there was an improvement in group 3 & 4, which were supplemented with probiotic & prebiotic.

Probiotic supplementation in chicken feeds improve the feed conversion ratio (28,29) while, other investigators could not detect any difference in feed conversion ratio (30,31). Recently, it has reported that poultry growth is promoted with the increasing dose of probiotics (32) and growth pattern of treated birds showed an increase in weight gain relative to control up to 1.0 gram/ 10 kg diet.

The suitable explanation for the improved weight gain is that lactobacilli included in the probiotic are among the indigenous flore colonizing the chicken's crop and intestine, such high- transit rate sites which must adhere firmly to the mucosal epithelium (33,34). This effect prevents the pathogenic bacterial from colonization along

intestinal wall and therefore prevent diseases (35), and increase resistance to infection (11). This improvement of the intestinal microbiota include competition for nutrients, production of toxic conditions and compounds (Volatile fatty acids, low PH and bacteriocins) and stimulation of immune system (11,36). Also, probiotics have effect on the main physiological functions of the gastrointestinal tract digestion, absorption and propulsion (37). Moreover, increasing of cells proliferation of small intestine with the use of probiotics confirm the results (31). The effect of Bio-mos in turkey diet was studied (38) suggested that biomos might be considered as a part of an overall feeding and management program to aid in overcoming potential loss of growth promoting antibiotics.

The antibiotics used for the hope of growth stimulation affect of the gut microflora, which results in the reduction of resistance to infection (39). Subtherapeutic antibiotics not only influence intestinal microbial population and activities but also, affect animal metabolism and intestinal function (40).

Table 3. Effect of probiotic, prebiotic and antibiotic on average body weight (g/bird) of broiler chick.

Group	Hatch weight	3 rd week	6 th week
1	42.5±0.18 ^a	748±18.34 ^c	1966±31.71 ^c
2	42.86±0.16 ^a	764±24.61 ^{bc}	2120±64.42 ^{bc}
3	42.6±0.19 ^a	836±19.64 ^a	2410±73.14 ^a
4	42.28±0.19 ^a	815±9.74 ^{ab}	2224±33.55 ^b

Means with different supercript in each column are significantly different (P<0.05).

Table 4. Effect of probiotic, prebiotic and antibiotic on overall growth performance parameters of broiler chickens (0-6 weeks).

Group	Treatment (0-3week)		
	Body weight (g)	Body wieght gain (g)	Feed conversion ratio
1	748±18.34 ^c	705.5	1.37
2	764±24.61 ^{bc}	721.1	1.49
3	836±19.64 ^a	793.4	1.44
4	815±9.74 ^{ab}	772.7	1.48
	Treatment (3-6week)		
1	1966±31.71 ^c	1218	2.24
2	2120±64.42 ^{bc}	1356	2.02
3	2410±73.14 ^a	1574	1.77
4	2224±33.55 ^b	1409	1.98
	Allover treatment (0-6 weeks)		
1	1966±31.71 ^c	1923,5	1.88
2	2120±64.42 ^{bc}	2077.1	1.78
3	2410±73.14 ^a	2367.4	1.56
4	2224±33.55 ^b	2181.7	1.69

Means with different superscriptis in each column are significantly different ($p < 0.05$).

Blood parameters

The effect of dietary treatment on serum biochemical parameters of broiler chickens are furnished in Table 5. The results revealed that dietary supplementation in group 3 & 4 had a significant improvement of the total protein level and serum globulin level. Also, there was a significant decrease in serum total cholesterol and triglycerides. These results are in agreement with earlier reports (41), where probiotic supplementation increased serum protein level (42). In addition, *Bacillus* species in probiotic has proteolytic activities that would increased protein digestibility (43). Moreover, probiotic supplementation in poultry diet decrease serum triglycerides which could be attributed to decreased fat absorption due to the ability of probiotics and normal inhabitant microflora for bile acid deconjugation (41). Total cholesterol was significantly decreased in group 3 & 4 in comparison with control and antibiotic group (1,2). The addition of probiotics to broiler diets has significantly reduced serum cholesterol and this may be due to assimilation or uptake of cholesterol by

lactobacillus cells, or coprecipitation of cholesterol with deconjugated bile salts or uptake of cholesterol by desirable bacterial cells and coprecipitation (44). The effect of dietary treatment on immune response of broiler chickens are shown in Table 6. The data demonstrate that HI antibody titers at 8,22,42 days of age the supplemented probiotic group 3 was significantly higher at all experimental period while there was no difference among other groups.

The effect of probiotics on immune system of poultry are interested and complicated. The direct effect might be related to stimulating the lymphatic tissue (45), and indirect effect via changing the microbial population of the lumen of GIT (46). It is obvious that probiotics are able to enhance the immune response to different antigenic stimulants. Recent studies have shown that consumption of some *lactobacilli* is able to confer arrange of health benefits including enhancement of immunity and improved resistance to infectious, illness and cancer (47).

In conclusion the results of the present study showed that supplementation of broiler diets with probiotics ensure its improvement effect on growth performance, serum

biochemical parameters as a natural food products with immunoenhancing properties, that are free of side – effects on animals and human health.

Table 5 . Effect of probiotic , prebiotic and antibiotic on serum biochemical parameters.

Group	Total protein (Mg/dl)	Albumin (Mg/dl)	Globulin (Mg/dl)	Total cholesterol (Mg/dl)	Triglycerides (Mg/dl)	Hb%
1	3.51±0.02 ^b	2.50±0.02 ^a	1.01±0.04 ^b	140.15±0.99 ^a	85.31±0.46 ^a	8.7±0.15 ^a
2	3.31±0.02 ^b	2.22±0.01 ^b	1.09±0.04 ^b	139.15±1.97 ^a	85.42±0.81 ^a	8.3±0.02 ^b
3	3.78±0.11 ^a	1.65±0.01 ^c	2.13±0.12 ^a	124.89±1.4 ^b	64.97±1.14 ^c	8.2±0.03 ^b
4	3.42±0.06 ^a	1.18±0.02 ^b	1.9±0.37 ^a	125.62±1.15 ^b	70.57±1.06 ^b	8.2±0.02 ^b

Means with different superscriptis in each column are significantly different(p<0.05).

Table 6. Effect of probiotic , prebiotic and antibiotic on immunoresponse of broiler chickens.

Group	8days	22days	42days
1	0.60±0.001 ^c	0.81±0.01 ^b	1.15±0.004 ^c
2	0.60±0.001 ^c	0.79±0.007 ^b	1.15±0.001 ^c
3	0.95±0.005 ^a	1.13±0.003 ^a	1.35±0.01 ^a
4	0.89±0.006 ^b	0.84±0.02 ^b	1.29±0.005 ^c

Means with different superscriptis in each column are significantly different (p0.05).

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الملخص العربى

تأثير البروبيوتك – البريبوتك والمضاد الحيوى على الأداء والمناعة فى بدارى التسمين

ولاء محمود عبد الرازق – محمود فتحى أحمد الجمل – مجدى السعيد الخولى

قسم التغذية والتغذية الإكلينيكية- كلية الطب البيطرى – جامعة الزقازيق

لقد تم دراسة تأثير اضافة البروبيوتك- البريبوتك – والمضاد الحيوى على معدلات الاداء والنمو وبعض قياسات الدم والاستجابة المناعية فى بدارى التسمين وقد استخدم فى هذه التجربة عدد ١٢٠ كتكوت هبرد عمر يوم غذيت على عليقة بادنة ثم عليقة نامية ناهية لمدة ثلاثة اسابيع لكل فترة من مدة البحث وقد تم تقسيمهم الى عدد اربع مجاميع كالتالى :

المجموعة الاولى: (المجموعة الضابطة): غذيت على عليقة ضابطة دون أية اضافات.

المجموعة الثانية: غذيت على عليقة ضابطة + المضاد الحيوى (فيرجيناميسين) ١٠ مل / كيلو جرام عليقة.

المجموعة الثالثة: غذيت على عليقة ضابطة + البروبيوتك (بريمالاك) جرام / كيلو جرام عليقة .

المجموعة الرابعة: غذيت على عليقة ضابطة + البريبوتك (ببيوموس) جرام / كيلو جرام عليقة .

وقد تم اضافتهم كمحفزات للنمو وقد تم وزن الطيور اسبوعيا وتحديد كمية الطعام المستهلك وكذلك تم قياس الزيادة فى وزن الطيور ومعامل التحويل الغذائى .

وتم أخذ عينات من الدم للحصول على مصل الدم لقياس كمية كل من البروتين الكلى – الألبومين – الجلوبيولين – الكولستيرول الكلى – والدهون الثلاثية – وكذلك نسبة الهيموجلوبين فى الدم.

وقد اظهرت النتائج ان تأثير اضافة البروبيوتك – البريبوتك الى العلائق فى خلال فترة التجربة ادى الى :-

- زيادة معنوية فى وزن الجسم – زيادة فى معامل التحويل الغذائى كما ادى الى زيادة البروتينات الكلية والجلوبيولين بينما ادى الى نقص نسبة الكولستيرول ودهون الدم.

وكذلك اوضحت النتائج أن اضافة البروبيوتك فى العليقة أدى الى تحسين قياسات المناعة فى الدواجن .

وإنتهت النتائج الى :-

أن استخدام البروبيوتك و البريبوتك كمحفزات طبيعية للنمو ادى الى تحسين معامل الاداء فى دجاج التسمين ورفع الحالة المناعية للطيور دون اى تأثيرات جانبية على الطائر .