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Effect of Probiotic, Prebiotic and Synbiotic on Broiler Performance

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Abstact: A feeding trial was conducted to investigate the effects of dietary supplementations of. probiotic (Bactocell), Prebiotic (Lactose and Myco) and synbiotic on broiler performance, carcass yield and organs weights, Six hundred 1-d-old broiler chicks were randomly assigned to 1 of 6 dietary treatments for 6 wk. The dietary treatments were 1) control, 2) basal diets supplemented with probiotic (1 kg of Bactocell / ton feed), 3) basal diets supplemented with prebiotic (lactose) (1 kg per ton of feed). 4) basal diets supplemented with prebiotic (Myco) (1 kg per ton of feed). 5) basal diets supplemented with synbiotic 1 (1/2 kg Bactocell +1/2 kg lactose per ton of feed). 6) basal diets supplemented with synbiotic 2 (1/2 kg Bactocell +1/2 kg Myco per ton of feed). The body weights, average daily weight gain, carcass yield percentage and feed conversion rate were significantly($P<0.05$). increased by the dietary inclusion of the probiotic and synbiotic as compared the control fed broilers. In conclusion, the probiotic, Prebiotic and synbiotic supplementation significantly increased BW and improved feed:gain ratios and decreased the mortality. The synbiotic offers a good alternative to improve poultry production.

Key words: Probiotic · Prebiotic · Synbiotic · Performance · Broilers

INTRODUCTION

Antibiotics are used in the poultry industry to prevent disease so as to improve meat and egg production. However, the use of antibiotics in feed resulted in development of drug-resistant bacteria [1], drug residues in the body of the birds [2] and imbalance of normal micro flora [3]. In addition, the banded use of dietary antibiotics driven the worldwide implantation of alternative strategies to prevent proliferation of pathogenic bacteria. As a consequence, it has become necessary to develop alternatives using either beneficial microorganisms or non-digestible ingredients that enhance microbial growth. A probiotic is a viable microbial dietary supplement that beneficially affects the host, either animal or man, through its effects in the intestinal tract [4]. The bacterial genera most often used as probiotics are lactobacilli and bifidobacteria although other groups are also represented [5]. The health-promoting effect of lactobacilli and bifidobacteria in the colon has been mainly associated with their capacity to stimulate the immune response and to inhibit the growth of pathogenic bacteria. Prebiotics-are indigestible carbohydrates, which passthrough small intestines and are broken down in the colon. Oligofructans and inulin are considered as the standard Prebiotics. They are not digested in the human or animal small intestine, but are selectively fermented in the colon by bifidobacteria to short-chain fatty acids, which in turn reduce ph in the colon, create unfavorable conditions for development of pathogenic bacteria and facilitates resorption of minerals. Avian species can not digest lactose because they lack of endogenous lactase, hence lactose present in the feed is being digested by intestine bacteria [6] In the course of these microbial processes more volatile fatty acids and lactic acid are released and more microbial proteins are produced [7]. Many studies have shown that, in contrast to other carbohydrates, lactose changes micro biota of large intestines by creating an acidic environment. Lower pH reduced the number of pathogenic bacteria, more ammonia is used for biosynthesis of microbial proteins and less gets into the blood [8,9]. It has been noticed that when lactose is used as prebiotic, the number of Lactobacillus reuteri bacteria in cul-de-sacs increases and

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the number of Salmonella bacteria in digestive tract of birds decreases [10]. The most relevant health benefits attributed to the consumption of probiotics and Prebiotics are: immune stimulation, enhancement of the resistance to infectious diseases, alleviation of lactose intolerance, improvement of serum lipids in hyperlipidemia, reduction of cholesterol and blood pressure, production of B-vitamins and an increase in calcium and magnesium absorption. As a dietary supplement the fructans help prevent constipation and regulate passage time, thereby reducing the risk of colonic cancer. Many scientific studies are being conducted in order to find the most effective probiotic and prebiotic supplements and to achieve a synbiotic action by using them in combination. Synbiotic are characterized by antimicrobial, ant carcinogenic, ant allergic and immunostimulating effect. They also improve absorption of minerals, protect from diarrhea and optimize nutrient digestion processes [11]. Results of studies of various combinations of synbiotic, probiotic and prebiotic preparations have yielded widely varying results and the mechanism of action of these preparations is not yet fully understood. The combination of probiotics and prebiotics (synbiotic) has not been well studied, but their beneficial effects might be additive or even synergistic. Thus the purpose of the present study is to investigate the effects of probiotic (Bactocell) and two prebiotic (Myco and lactose) preparations and their combinations on broiler productivity and feed consumption per unit of output.

MATERIALS AND METHODS

Birds: Six hundred, one d-old male Hubbard broiler chicks were obtained from a local commercial hatchery. Chicks were vaccinated for Newcastle, infectious bronchitis and Marek's disease at the hatchery. Chicks were randomly allocated to 5 experimental treatments for 6 wk. Each treatment had 5 replicates of 15 broilers. Each replicate was assigned to a clean floor pen (2 x 1 m) and birds were raised on a wood shaving.

Dietary Treatment: The 1st group was served as the control group and the 2nd, 3 rd 4 th 5h tand 6h tgroups were experimental groups.

Probiotic Bactocell ® (obtained from Lallemand SAS in France) was added to combined feed of the 2nd group of chicks at a rate of 1 Kg product/ton of starter (1-14 day) and grower(15-42) feeds

Birds of the 3rd group had lactose added to their feed (prebiotic 1) at a rate of 1 Kg lactose/ton of starter (1-14 day) and grower (15-42) feeds irds of the 4 th group was supplemented by the prebiotic Myco® at a rate of 1 Kg product/ton of starter (1-14 day) and grower(15-42) feeds

Birds of the 5 thgroup of was supplemented by the probiotic Bactocell® and prebiotic lactose at a rate of 12 Kg Bactocell® and 1/2 kg lactose /ton (synbiotic 1) of starter(1-14 day) and grower (15-42) feeds

Birds of the 6 thgroup of was supplemented by the probiotic Bactocell® and prebiotic Myco at a rate of ½ Kg Bactocell® and 1/2 kg Myco /ton (synbiotic 2) of starter (1-14 day) and grower (15-42)

Bactocell®"is a preparation made of the probiotic lactic acid bacteria strain Pediococcus acidilactici MA 18/5M 1×100 1 CFU/g. The preparation had been manufactured by Lallemand SAS in France. Lactose is a lactic sugar (lactose monohydrate).

Lactose is a disaccharide composed of $-D-galactose and $-D-glucose. White powder, ingredients: lactose min. 99 %, proteins <1%, humidity <1%.

Myco is a prebiotic composed of mannose oligosaccharides derived from the cell wall of the yeast Saccharomyces cerevisia The preparation had been manufactured by Probyn international, USA.

Growth Performance Traits: All birds were weighed individually after their arrival from the hatchery to the experimental farm (initial weight) and on day 42. Daily weight gain for each dietary treatment was calculated. Feed consumption was recorded in the course of the whole experiment for each treatment and the feed conversion rates were calculated subsequently

Organ Weights and Carcass Yield Percentages: At the end of experiment, after weighing, 5 birds per treatment were randomly selected and slaughtered. The proventrculus, gizzard, small intestine (duodenum, jejunum and ileum), heart , spleen , liver , cecum and colon were excised and weighed. The gastrointestinal tract was weighed after removal of the content. Afterward, the birds were scalded, de-feathered and carcasses were eviscerated. The head, neck and feet were removed and the carcass weight was then determined and the carcass yield percentage was calculated by dividing the carcass weight by the live BW of birds multiplied by 100.

Statistical Analyses: Statistical analyses were conducted using analysis of variance on the SAS 6.0. Significance of differences between groups was determined using the Duncan test forpost-hoc comparisons. Differences were considered significant if P<0.05.

RESULTS

Growth Performance: The initial BW of chicks did not differ between the dietary treatments (Table 1). At the end of the experiment (d 42), birds supplemented with the synbiotic 1 and 2 had a greater body weight (2.210± 0.156 and 2.225± 0.136, respectively) as compared with controls (2.15± 0.175 kg). Moreover, probiotic, prebiotic 1 and prebiotic 2-supplementedbirds had a greater body weight (2.185± 0.18, 2.169±0.193 and 2.174 ± 0. 206 respectively) than the control birds (Table 1).

Daily Weight Gain: The average daily weight gain (from d 1 to 42) increased for birds supplemented with synbiotic 2 (51.89g) and synbiotic 1 (51.53) compared with control birds (50.10) and birds supplemented with probiotic (50.87), prebiotic 1 (50.51) and prebiotic 2 (50.70).Furthermore, probiotic, Prebiotic 1 and prebiotic 2-supplemented birds had a slight greater daily weight gain than control birds (Table 1).

Effect of Feed Conversion Rate Mortality and Carcass Percentage: Feed conversion rate (FCR) was lower for birds supplemented with synbiotic 2(1.77) and synbiotic 2 (1.79) than control birds (1.87) and birds supplemented with probiotic (1.81), Prebiotic 1 (1.86) and prebiotic 2 (1.84). In addition, probiotic and prebiotic 2-supplemented birds had a lower FCR than control birds (Table 2).

The mortality rate was lower for the probiotic, synbiotic1 and synbiotic2-supplemented group (2%) than both the prebiotic1 and prebiotic 2-supplemented group (3%) compared to control group (4%).

The means of the carcass weight percentage relative to the BW for control group, probiotics, Prebiotic 1 and 2 as well as synbiotic 1 and 2 supplemented groups are recorded in Table 2.

The probiotic and synbiotic2-supplemented group had a greater (P< 0.05) carcass percentage (65.27 , 64.7 and 66.94% respectively) compared with the control group (61.1%) and prebiotic 1 and 2- supplemented group (61.3 and 60.9 %, respectively), (Table 2).

Effect of Feed Supplementations on Absolute Weights of Organs: The means of the absolute weights of organs for dietary treatments are recorded in Table 3. The weight of proventriculus decreased for the synbiotic2-supplemented group (6.5 ± 0.47 g) and Prebiotic 2 (7.3 ±0.37) compared with the control group (8.5 ± 0.27 g) and other supplemented group (Table 4). In addition, the symbiotic 1 and 2-supplemented group showed a decrease in liver weight (37.4 ±1.2and 34.5 ± 2.27 g) compared with either the control group (44.3 ± 3.22 g) or other-supplemented groups (Table3). The weight of spleen and heart were significantly lower in the synbiotic 1 and 2-supplemented group (10.5± 0.57 and 10.8± 0.81 g) than in the other-supplemented groups and control group (11.8± 0.57 g).

Table 1: Effect of feed supplementations on BW (g) and daily weight gain (g), of the experimental birds 1

	Dietary treatment					
Parameter	Control	Probiotics	Prebiotic 1 Lactose	Prebiotic 2 Myco	Synbiotic 1	Synbiotic 2
Initial B WT(g)	42.4± 1.2[a]	43.1± 2.3	42.8± 0.79	42.8± 1.54	42.0± 0.87	41.8± 0.74
Weight at d 42 (kg)	2.15 ± 0.175	2.185± 0.184	2.169± 0.193[c]	2.174± 0.206[d]	2.210±0.156[b]	2.225± 0.136[a]
Daily weight gain (g)	50.10± 0.42	50.87± 0.47	50.51± 0.31	50.70± 0.39	51.53± 0.47	51.89± 0.34

[a,b] Means with different superscripts within the same row differ significantly (P≤0.05).

Table 2: Effect of feed supplementations on FCR and mortality and carcass percentage of the experimental birds

	Dietary treatment					
Parameter	Control	Probiotics	Prebiotic 1 Lactose	Prebiotic 2 Myco	Synbiotic 1	Synbiotic 2
FCR	1.87	1.81	1.86	1.84	1.79	1.77
Mortality %	4	2	3	3	2	2
	61.1 ± 1.37	65.27± 1.19	61.3±1.59	60.9±0.78	64.7± 1.14	66.94±1.57

Table 3: Effect of feed supplementations on absolute organ weights (g) of broiler chickens (n=5)

	Dietary treatment					
Organ	Control	Probiotic	Prebiotic 1 Lactose	Prebiotic 2 Myco	Synbiotic 1	Synbiotic 2
Proventriculus	8.5 ± 0.27[c]	8.2 ± 0.3[c]	8.2 ± 0.3[c]	7.3 ± 0.37[b]	8.3 ± 0.22[c]	6.5 ± 0.47[a]
Gizzard	44 ± 2.34[c]	44± 1.98[c]	43.5 ± 3.2[c]	42.5 ± 2.47[b]	41.9 ± 1.57[b]	41.5 ± 2.47[a]
Small intestine	56. 4 ± 3.6[d]	56.5 ± 3.1[d]	58.8 ± 2.37[c]	57.8 ± 2.37[c]	59.7± 1.14[b]	61.54±1.57[a]
Liver	44.3 ± 3.22[c]	44.4 ± 2.1[c]	43.7 ± 3.24[c]	44.1 ± 2.47[c]	37.4 ± 1.2[b]	34.5 ± 2.27[a]
Heart and spleen	11.8± 0.57[b]	12.4 ± 0.62[b]	12.6 ± 0.81[b]	11.6± 0.38[b]	10.5 ± 0.57[a]	10.8 ± 0.81[a]
Cecum and Colon	10.8 ± 0.27[b]	10.9 ± 0.38[b]	11.1± 0.62[b]	10.9± 0.49[b]	9.6± 0.35[a]	9.1±0.57[a]

DISCUSSION

The primary role of feed is not only to provide enough nutrients to fulfill metabolic requirements of the body but also to modulate various functions of the body. Probiotics, Prebiotics and synbiotic are either beneficial microorganisms or substrates that facilitate the growth of these microorganisms, which can be suitably harnessed by the food manufacturers and hold considerable promise for the health care industry.

Various authors have noted that probiotics improve birds growth parameters [12, 13]. Probiotics stimulate the immune system of an organism, increasing its protective capacity against pathogenic bacteria, as well as stimulating production of certain digestion enzymes, vitamins and other biologically active substances, all of which affect organism's health via its digestive tract [14].

Improvement in growth performance and feed efficiency of broiler chickens fed probiotics [15-20] may be attributed to the total effects of probiotic action including the maintenance of beneficial microbial population [4], improving feed intake and digestion [21] and altering bacterial metabolism [22, 23]. Avian species can not digest lactose because they lack of endogenous lactase, hence lactose present in the feed is being digested by intestine bacteria [6]. In the course of these microbial processes, more volatile fatty acids and lactic acid are released and more microbial proteins are produced [7]. Many studies have shown that, in contrast to other carbohydrates, lactose changes micro biota of large intestines by creating an acidic environment. Lower pH reduced the number of pathogenic bacteria, more ammonia is used for biosynthesis of microbial proteins and less gets into the in increases and the number of Salmonella bacteria in digestive tract of birds decreases [10]. Probiotics and Prebiotics play an important role in formation of stable intestine micro flora and affect both health and development of the intestine. Intestine micro flora plays an important role in feed digestion and conversion. Use of probiotics in poorer industrial bird production conditions or for weaker bird groups may produce higher productivity effect [13].

In the present study, the beneficial effects of probiotic (Bactocell) and two prebiotic (Myco and lactose) preparations and their combinations (synbiotic1 and 2) on broiler performance parameters including average daily BW gain, FCR and BW are in agreement with previous studies (15;16;17;18;19;20) However, the synbiotic 1 and 2 product displayed a greater growth-promoting effect than the probiotic Lactobacillus sp. product and increased the carcass yield percentage. In addition, there was a highly significant difference in the carcass yield between synbiotic 1 and 2 (5.9 and 9.55 %) groups , probiotic (6.8%) compared to control groups. The main reasons for this may be the following: the greater live BW of the synbiotic group compared with control, the lower absolute weights of organs of the synbiotic group compared with control and the carcass yield percentage

Studies reported in the literature indicated that high amounts of lactose may reduce weight gain and cause diarrhea, but quantities under 10 percent do not have any negative effects on growth of birds [24]. Prebiotic effect of lactose had a positive effect on growth of broiler during periods of growth.

CONCLUSION

- Under the influence of Bactocell®, weight of broiler during the initial periods exceeded those of birds assigned to the control group by 1.53 percent and the FCR was improved by 3.2%.
- Under the influence of the Prebiotic lactose broilers body weight was higher by 0.88 percent period and the FCR was improved by 0.5%.
- Under the influence of the Prebiotic MYCO broilers body weight was higher by 1.1 percent and the FCR was improved by 1.6 %.

- Under the influence of the synbiotic 1 combination of Bactocell® and lactose of weight was higher by 2.79 percent and the FCR was improved by 4.2 %.
- Under the influence of the synbiotic 2 combination of Bactocell® and MYCO of weight was higher by 3.4 percent and the FCR was improved by 5.34 %.

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