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EFFECT OF DIETARY PREBIOTICS, PROBIOTICS AND SYNBIOTICS AS FEED ADDITIVES ON BLOOD PROFILE AND BROILER PERFORMANCE

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Abstract: This study was undertaken to investigate the effect of incorporating prebiotics, probiotics and synbiotics as a growth promoter in broiler feed on growth performance and blood profile. 240 day-old commercial broiler chicks (Cobb-400) were divided equally into four groups of 60 birds each, and were assigned to four isocaloric isonutritive diets, viz., Diet-I basal control diet without additives, Diet-II prebiotics (500g/tonne), Diet-III probiotics (100g/tonne) and Diet-IV synbiotics (250g/tone prebiotics+ 50g/tone probiotics). The experiment was conducted in three replicates each of 20 birds. Feed and water were offered *ad libitum* till the termination of the trial at 42 days. The starter and finisher diets were given to birds from 1 to 28 and 29 to 42 days of age, respectively. Growth performance parameters and blood parameters were measured. Broilers fed Diet - II had significantly ($P<0.05$) increased feed intake. Body weight, body weight gain and efficiency of feed utilization of birds were superior with Diet-IV. Values for different haemato-biochemical parameters like hemoglobin (Hb), packed cell volume (PCV), total erythrocyte count (TEC), total leucocyte count (TLC), alanine transaminase (ALT) and aspartate amino transferase (AST) were found non-significant among different experimental groups, but the values of all were within normal range. It was thus concluded that use of synbiotics (250g/tonne prebiotics + 50g/tonne probiotics) and prebiotics (500g/tonne), improves the overall performance without altering the normal blood values of broilers.

Keywords: Prebiotics, Probiotics, Synbiotics, Broiler Performance, Haematology.

Introduction

Feed additives are commonly described as non-nutrient substances that accelerate growth, efficiency of feed utilization and are beneficial for health or metabolism of the animals (Church and Pond, 1988). Antimicrobial compounds produced by microorganisms have been used in poultry rations as growth promoters for many years (Barragry and Powers, 1994). But these antibiotics are posing serious health risks to human, because of their residual effects in

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poultry meat and eggs resulting in development of resistance to antibiotics. Consequently, the use of natural promoters such as probiotics, prebiotics, synbiotics, enzymes, toxic binders, organic acids, oligosaccharides, phytogenics, and other feed additives, to enhance the growth and performance of broiler chickens have been advocated (Borazjanizadeh *et al*., 2011). Therefore, this study was conducted to generate more information about the effect of using prebiotic and probiotic alone and in combination on performance and carcass characteristics in the diet of broiler chickens.

Material and Methods

One day old 240 broiler chicks of cobb-400 strain were wing banded and distributed randomly into four groups having three replicates of 20 birds each by randomized block design and allocated to four dietary treatments as T_1, T_2, T_3 and T_4. Control diet (T_1) without probiotics, prebiotics or synbiotics supplementation, while, birds in group T_2, T_3 and T_4 were fed with diets containing prebiotics (Nutriferm@500g/ton), probiotics (Protexin@100g/ton) and a combination of prebiotics and probiotics (Nutriferm@250g/ton+Protexin@50g/ton), respectively. Feed and water were provided *ad libitum*. Continuous light was supplemented throughout the experimental period. All the birds were weighed weekly. Feed intake was calculated by deducting residue left after 24 hours. Samples of feeds were analysed as per AOAC (1995). For carcass quality, tenderness and sensory evaluation i.e. (Appearance, touch, flavour, and taste) were done using Hedonic scale. The data collected on various parameters were analysed as per the methods of Snedecor and Cochran (1994).

Results and Discussion

Nutrient composition of broiler experimental feeds was found to be iso-nitrogenous and comparable. Average total feed intake (g) found was significantly ($P<0.05$) higher in different treatment groups like D-II, D-III and D-IV as compared to control (D-I) group (Table I). Similar findings were also reported by many workers. Sanchez and Ayaya (1998), Abudabos *et al*. (2015), Mokhtari et *al*. (2015) reported significant effect of prebiotics supplementation on feed intake in broilers. While, Taherpour *et al.* (2009) and Houshmand *et al.* (2012) reported decreased feed intake in prebiotics supplemented group. Khan *et al.* (2000), Anjum *et al.* (2005) and reported significantly higher feed intake on feeding probiotics in experimental birds. However, Murarolli *et al*. (2014), Abudabos *et al*., (2015) and El-Shenway and Soltan (2015) found non-significant effect of prebiotics and Salianeh *et al*., (2011) and Sarangi *et al*., (2016) reported non-significant effect of probiotics on feed intake in broilers.

Experimental groups supplemented with prebiotics, probiotics and synbiotics showed significantly ($P < 0.05$) higher value for body weight gain in terms of average weekly (g) and total body weight (g) gain as compared to control group (Table I). This could be due to beneficial effects of prebiotics, probiotics and synbiotics supplementation which have promoted favorable condition in the intestine for the colonization of beneficial microflora, which have further facilitated better growth performance of broiler chicks. Many workers reported significant beneficial effect of supplementation of prebiotics (Ashayerizadeh *et al.,*2011 and Nikpiran *et al*., 2013), probiotics (Awad *et al*., 2009; Munj *et al*., 2010 and Ashayerizadeh *et al*., 2011) and synbiotics (Awad *et al*., 2009; Ghahri *et al*., 2013 and Ahmed *et al*., 2015). On the other hand, non- significant effect of probiotic supplementation was also reported by different workers like Elfaki and Mukhtar (2015) and Mokhtari *et al*., (2015).

Final body weights of broilers increased significantly ($P < 0.05$) in all treatment groups (D-II, D-III and D-IV) as compared to control group (D-I). Highest total body weight of experimental birds was observed in synbiotics supplemented group (D-IV) followed by prebiotics (D-II), probiotics (D-III) and control group (D-I). Improvement in body weight in treatment groups D-II, D-III and D-IV might be due to better feed utilization and nutrient availability to birds. Several mechanisms are anticipated to explain the positive effects of prebiotics on broiler performance and health. This includes reducing disease incidence by inhibiting gut lining colonization by pathogenic bacteria, prevention of proliferation and toxins production by reduction of intestinal pathogens (Benites *et al*., 2008). Probiotics have been reported to prevent gut colonization by pathogenic bacteria, such as *C. perfringens, Escherichia coli, Campylobacter spp*. and *Salmonella spp.* through the mechanism of competitive exclusion.

Mean values for FCR of broilers (Table 1) were significantly ($P<0.05$) lower in different treatment groups like D-II, D-III and D-IV as compared to control (D-I) group. FCR was found to be the lowest in D-IV group followed by D-II, D-III and D-I groups. In the present study, beneficial effects of a probiotic, prebiotic and synbiotic products on FCR are in good agreement with previous studies (Ahmed *et al*., 2015; Mokhtari *et al*., 2015; Zaghari *et al*., 2015). In contrast, El-Shenway and Soltan (2015) and Sarangi *et al*. (2016) reported that using these additives in the broiler ration has non-significant effects on FCR of broiler chickens. Prebiotics, probiotics and their synergistic effect could reduce the count of pathogenic bacteria and increase the population of useful microflora in gut (Rada *et al*., 1995;

Fairchild *et al*., 2001). Thus it can be presumed that by removing pathogenic bacteria adhered to the gastrointestinal tract wall, immune system may be less stimulated and a favourable medium gets created for better use of energy and nutrients by birds (Ashayerizadeh *et al*., 2011). Also, the use of prebiotics by increasing in length of the intestinal villi increases the absorption area and improves the birds' energy and protein efficiency ratio (Santin *et al*., 2001). Furthermore, the effect of probiotics and prebiotics on reduction of pathogenic bacteria could reduce the breakdown of proteins to nitrogen in GIT and hence improves the utilization of proteins (amino acids). Thus each one of above process as individual way or collectively is found to be responsible for better performance of broiler birds in treatment groups as compared to control.

The average values of haemato-biochemical parameters are presented in Table 2. Statistical analysis of Hb and PCV values revealed non-significant difference among control and D-II, D-III and D-IV groups. Similar non- significant effect was observed by different workers on feeding of prebiotics (Nyamagonda *et al*., 2009), probiotics (Alkhalf *et al*., 2010 and Ahmed *et al*., 2015) and synbiotics (Nyamagonda et *al*., 2009 and Ahmed *et al*., 2015) for Hb and PCV values. Whereas, El-Shenway and Soltan (2015) found significantly ($P < 0.05$) increased values for Hb and PCV in broilers birds fed with prebiotics, probiotics and synbiotics. Result of statistical analysis of TEC and TLC values indicated non-significant difference among all experimental groups. i.e. D-I,D-II, D-III and D-IV. Similar non-significant values of TEC ($\times 10^6$/µl) were reported by Nyamagonda *et al*., (2009) and El-Shenway and Soltan (2015) in birds fed with prebiotics supplemented diets. Whereas, Nyamagonda *et al*, (2009), Ahmed *et al*. (2015) and El-Shenway and Soltan (2015) found non-significant values of TEC ($\times 10^6$/µl) in birds fed with probiotics and synbiotics. On the contrary El-Shenway and Soltan (2015) and Szakacs *et al*. (2015) found significantly higher TEC ($\times 10^6$/µl) and TLC ($\times 10^3$/µl) values when fed prebiotics, probiotics and synbiotics to the broiler birds. Habibu *et al.,* (2016) also found significantly higher TEC ($\times 10^3$/µl) and (TLC) ($\times 10^6$/µl) values on feeding prebiotics, probiotics and synbiotics to Pearl Guinea Fowls (*Numida meleagris*) which might be attributed to species difference.

Statistical analysis of AST and ALT values revealed non-significant difference among control and D-II, D-III and D-IV groups. Serum AST activity is present both as cytoplasmic and mitochondrial enzyme which is released by even mild degenerative change that occurs in acute and occasionally in chronic liver diseases but remarkably higher values are recorded in muscle damage (Pensent, 1983). Activity of AST and ALT is an indicator of damage to liver

and muscles (Casteel, 1999). However, activities of both AST and ALT in present study were within the normal physiological range and did not differ significantly ($P<0.05$) among dietary treatments. Present findings are in consonance with the findings reported by different research workers. Abdel-Fattah and Fararh (2009) found non-significant effect of prebiotics, probiotics and synbiotics supplementation on serum AST and ALT values in broiler birds. Similar non-significant effect was reported on probiotics and synbiotics supplementation (Ahmed *et al*., 2015 and El-Shenway and Soltan, 2015) and synbiotics supplementation (Elfaki and Mukhtar, 2015) in broilers.

Conclusion

It is concluded that the prebiotic and probiotic as feed additives either alone or in combination has significant growth performance enhancing effect in broiler chicks without any side effects as detected by normal physiological blood profile.

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Table 1: Effect of prebiotics, probiotics and synbiotics on performance of broiler chicks

Performance parameters	Treatments (n=20)			
	Control (D-I)	Prebiotics (D-II)	Probiotics (D-III)	Synbiotics (D-IV)
Body Weight (g/bird)	1790.83^{c} ±23.64	2030.83^{a} ±34.59	1955.50^{b} ±32.98	2038.30^{a} ±45.19
Feed Intake (g/bird)	3140.10^{d}± 22.95	3325.00^{a}± 22.38	3301.30^{b}± 14.98	3283.90^{c}± 83.30
Body Weight Gain (g/bird)	1735.67^{c}± 23.29	1975.50^{a}± 34.58	1900.60^{b}± 33.10	1983.47^{a}± 45.06
FCR	1.81^{a}± 0.27	1.68^{b}± 0.18	1.74^{b}± 0.20	1.66^{b}± 0.15

^{abc}Means bearing different superscripts in a row differ significantly ($P<0.05$)

Table 2: Hemato-Biochemical profile of experimental birds

Parameters	Treatments (n=20)			
	Control (D-I)	Prebiotics (D-II)	Probiotics (D-III)	Synbiotics (D-IV)
Hb (g/dl)	10.2 ± 0.33	10.2±0.66	10.4±0.21	11.2±0.22
TEC ($\times 10^{6}$/µl)	2.3±0.20	2.2±0.10	2.8±0.17	2.4±0.14
TLC ($\times 10^{3}$/µl)	25.8±0.36	24.7±3.50	17.5±1.25	22.3±2.37
PCV (%)	25.2±0.36	24.2±0.78	24.3±1.30	28.2±0.76
ALT (IU/L)	11.5±2.62	14.3±0.98	9.2±0.49	11.0±2.62
AST (IU/L)	56.5±1.87	55.5±5.33	58.0±2.49	60.6±2.88