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Effect of Dietary Supplementation of Multienzymes with Prebiotics and Probiotics on Growth Performance and Feed Conversion Efficiency of Broilers

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A B S T R A C T

The present piece of research was executed to evaluate the effect of multienzymes, prebiotic and probiotic combination on growth performance, weekly feed intake and feed conversion ration (FCR) in broiler birds. All the broiler chicks were fed with starter ration up to 21 days and finisher ration from 22 to 42 days of age. The chicks in treatment groups fed basal diet with varying dose of Multienzyme @ 0, 0.1, 0.2 and 0.3 per cent respectively, with constant levels of Prebiotics (Fructooligosaccharides @ 0.05%) and Probiotics (Saccharomyces cervisiae @ 0.01 %) to all the treatments. The weekly body weight changes of chicks indicated significant ($P<0.05$) difference among various treatment groups throughout the experiment. However, at the end of the sixth week, significantly ($P<0.05$) higher body weight gain in the group (Multienzyme @ 0.3% with Prebiotics @ 0.05% and Probiotics @ 0.01%) group was recorded. The overall feed intake of the birds showed non-significant differences in second and third week of the experiment. While feed intake is significant ($P<0.05$) in first, fourth, fifth and sixth week of experiment. All treatments were statistically significant ($P<0.05$) for FCR except first week. Better FCR was recorded in group (Multienzyme @ 0.3% with Prebiotics @ 0.05% and Probiotics @ 0.01%) treatment as compared to other treatments.

Introduction

Poultry industry continuous to be one of the fastest growing segments of Indian economy that is contributing about 8-10 per cent of the gross national income. Today, India is the one of the world's largest producer of broiler meat. Broiler meat in the past had been considered to be a delicacy, but now with increasing trend in financial status with changing food habits and because of increasing levels of urbanization and higher levels of disposable incomes, broiler meat is seen not as luxury food product but as a staple

diet. To meet the demand of growing population especially in developing world a number of feed additives like steroids, vitamins, minerals, antibiotics and other growth promoters are used to improve the growth performance of broiler birds. The indiscriminate exploitations of medications especially shared by animals and human being threaten the mankind in development of multiple antibiotic resistant strains of bacteria. So to overcome these drugs to be exploited in Poultry as growth promoters alternatives needs to be included as a growth promoter that does not have the effect of multiple drug resistance. Among these, Probiotics are feed additives that contain live microorganisms and promote beneficial effects on the host favoring the balance of the intestinal microbes (Fuller, 1989) that contribute to maintain balance in intestinal microflora (Islam *et al.*, 2004).

The other way is combination of feed enzymes, Prebiotic and Probiotics that can achieve maximum utilization of nutrients from the available feed stuffs. Enzymes are a biological protein catalyst that facilitates the digestion of feed by accelerating the rate of specific chemical reaction and Probiotics help in regulation of gut health, while Prebiotic is a kind of growth material of microbial secretion that stimulates growth of another microbial population.

The nutritive value of available feed stuffs such as wheat, maize, rice polish, different oil cakes, soybean meal etc. in India contain more indigestible part. Most of the feed ingredients contain some anti-nutritional factors and non- digested part which inhibit feed utilization. The anti-nutritional effect is manifested by decreased nutrient utilization accompanied by poor growth. This adverse effect can be overcome by supplementation of exogenous multienzymes, Prebiotics and Probiotics.

Materials and Methods

Experimental site and climate

Research was conducted at Division of Animal Husbandry and Dairy Science, College of Agriculture, Dhule, Maharashtra, India. The minimum and maximum ambient temperature range from 10^0 C to 15^0 C in winter and 35^0 C to 40^0 C in summer with annual rainfall of 612 mm.

Feeding of Enzymes, Prebiotics and Probiotics

Enzymes (Cocktail Enzyme) was procured and mixed in commercial broiler feed manufactured as per different treatment levels with constant dose of Prebiotics and Probiotics.

Housing and management

All the experimental chicks were reared in deep litter system with use of paddy husk as a litter material in a well-ventilated house with identical management and environmental conditions.

Selection of experimental chicks

For the present study 120 chicks of day old age, commercial straight run broiler chicks of Vencob strain were procured from Government approved hatchery near to Dhule, Maharashtra. On arrival, chicks were weighed and distributed randomly into 4 treatment groups *viz*, T_0, T_1, T_2, and T_3 with 30 chicks in each treatment, on equal weight basis.

Treatment details

The dietary treatments are as follows,

T_0 - Control [Basal Diet + Prebiotics (0.5g per 1kg mash) and Probiotics (0.1g per 1kg mash)]

T_1 - Basal Diet + Prebiotics (0.5g per 1kg mash) and Probiotics (0.1g per 1kg mash) + Multi-enzyme (0.1 % of mash)

T_2 - Basal Diet + Prebiotics (0.5g per 1kg mash) and Probiotics (0.1g per 1kg mash) + Multi-enzyme (0.2 % of mash)

T_3 - Basal Diet + Prebiotics (0.5g per 1kg mash) and Probiotics (0.1g per 1kg mash) + Multi-enzyme (0.3 % of mash)

Proximate Composition of Experimental Broiler Ration

It was observed that experimental broiler rations contained adequate nutrients for growth as per BIS (1992).

Starter ration

The proximate composition of experimental starter ration is given in Table 1. The crude protein and calculated metabolizable energy (ME) of the diet was 22.9 per cent and 2863.83 Kcal/kg, respectively.

Finisher ration

The proximate composition of finisher ration is given in Table 1. The crude protein and calculated metabolizable energy (ME) of the diet was 20.0 per cent and 2939.78 Kcal/kg, respectively.

Observations recorded

Body weight

The weight (g) of the all experimental birds was recorded individually on electronic weighing balance at weekly intervals. The weights were recorded on 7th day morning before offering fresh water and feed and subsequently at 7 days interval. Live weight gains were calculated by subtracting live weight of previous week from that of current week.

Feed intake

Daily feed intake was calculated from the amount of feed consumed by each group in a day. Average feed intake was calculated from the total feed offered and the feed left over on the next day morning. Weekly feed intake was calculated by adding up the daily average feed intake of the particular week. Cumulative feed intake of particular week was calculated by adding up the weekly average feed intake of the previous weeks with the feed intake of that particular week. Value for the weekly feed intake per birds were calculated as below,

$$\text{Weekly feed intake (g/bird)} = \frac{\text{Total feed intake by all birds in a treatment during a week}}{\text{No. of live chicks in a treatment during that week}}$$

Similarly, cumulative feed intake was calculated with the addition of these values upto that week.

Feed Conversion Ratio (FCR)

Weekly FCR was calculated by dividing the weekly feed consumption by weekly weight gain. The weekly cumulative feed conversion ratio was estimated by dividing the cumulative feed consumption or total amount of feed consumed up to that particular week by the body weight gain recorded upto that week.

Weekly feed conversion ratio was calculated by using following formula,

$$\text{FCR} = \frac{\text{Feed consumption (g) during the week}}{\text{Gain in body weight (g) during the week}}$$

Live weight

Birds were weighted before slaughtering using an electronic balance.

Dressed weight

After slaughtering, the dressed birds were weighted and dressed weight was calculated as follows,

$$\text{Dressed weight (g)} = \frac{\text{Weight of dressed bird (g)}}{\text{Live weight of bird (g)}}$$

Statistical analysis

The data were analyzed using General Linear Model procedure of statistical package for social sciences (SPSS) and comparison of means tested using Duncan's multiple range test (1997) and significance was considered at ($P<0.05$).

Results and Discussion

Growth performance

Growth performance is related to the body weight changes of broiler chicks at different weekly intervals fed with Multi-enzyme, and constant levels of Prebiotics and Probiotics in feed are represented in Table 2. The results of this present investigation indicated that 0.3 per cent Multi-enzyme supplementation with constant level of Prebiotics (0.05 %) and Probiotics (0.01 %) in diet significantly improved the growth performance of broiler chickens as compared to 0.1 and 0.2 per cent Multi-enzyme supplementation with constant level of Prebiotics (0.05 %) and Probiotics (0.01 %). The results obtained from many studies in that the effects of probiotic, prebiotic, enzyme or their combinations were investigated on growth performance in poultry, were not consistent. Kamel *et al.*, (2016) showed that supplementation of the prebiotic to the diet, either alone or in combination with probiotic had significantly higher body weight to Cobb breed than Ross breed from the first day of age till 42nd day of age. Similarly, Goli and Shahryar (2014) observed that the lowest weight gain was observed in control group while the highest were obtained in groups that fed with multi enzyme supplementation.

Body weight changes

The body weight changes of broiler chicks at different weekly intervals fed with Multienzyme, and constant levels of Prebiotics and Probiotics in feed are represented in Table 2. The body weight changes of chicks indicated significant difference among treatment groups during all the weeks of the experiment except birth weight.

The cumulative body weight at first week of age for treatment T_0, T_1, T_2 and T_3 were 185.20, 190.48, 194.79 and 199.53 g, respectively. The higher body weight gain was observed in treatment T_3 (199.53 g) followed by T_2, T_1 and control. During the second week, significantly ($P<0.05$) higher body weight gain was observed in treatment T_3 than the other treatment group. The cumulative body weight at 3rd week of age for treatment T_3 was significantly ($P< 0.05$) higher over the other treatment groups. The cumulative body weight gain at 4th and 5th week of age was observed significantly ($P< 0.05$) higher in T_3 followed by T_2, T_1 and control.

The average final body weight of experimental chicks at 6th week of age was 2,076.97, 2,100.82, 2,124.64 and 2,152.29 g, respectively. At the end of the sixth week, significantly ($P<0.05$ %) higher body weight gain in the T_3 group was recorded. Results are in agreement with the Kirkpinar *et al.*, (2018) who observed that Probiotic, probiotic + prebiotic and probiotic + enzyme supplementation significantly increased body weights upto 42 days and body weight gains during the 0 to 42 days ($P<0. 05$). Similar

findings of Thorat *et al.*, (2015) who also recorded that constant levels of Prebiotics and Probiotics with higher level of Multienzymes (100 g/ 100 kg of feed, had better body weight gain as compare to lower levels of Multienzymes (50 g / 100 kg of feed.

Body weight gain

The body weight gain of broiler chicks at different weekly intervals on inclusion of Multi-enzymes with Prebiotics and Probiotics in feed has been presented in Table 3. The body weight gain during 2nd, 3rd, 4th and 5th week of age also showed significant differences among all the groups that were higher in T_3 treatment followed by T_2, T_1, and Control (T_0).

In the sixth week, significantly (P<0.05 %) higher body weight gain was observed in the T_3 (533.97 g) followed by T_2 (530.96), T_1 (528.10) and control (524.26) g, respectively.

There is likelihood that enhanced metabolism has valuable impact on weight gain in multi-enzyme, prebiotic and probiotics treated groups as compared to control group. The enhanced in weight gain of broiler chickens in T_3 group as observed in the present study may be attributed to the fact that the digestibility of crude protein and energy present in the form of non-starch polysaccharides (NSPs) might have increased thus increasing availability to the birds for utilization and overall increasing of body weight.

Table.1 Proximate chemical composition of experimental broiler ration (% DM basis)

Nutrients	Broiler ration	
	Starter	Finisher
Crude protein	23.10	20.13
Crude fiber	4.63	3.79
Ether extract	4.80	4.30
Total ash	7.20	6.85
Nitrogen free extract	60.40	65.15
Acid insoluble ash	1.25	1.44
ME (Kcal/kg)	2863.83	2939.78

Table.2 Effect of supplementation of Multienzymes with constant levels of Prebiotics and Probiotics on cumulative body weight changes of broilers

Weeks	Treatments				Mean SE (±)	CD @ 5%
	T0	T1	T2	T3		
Birth Weight	42.52	42.54	42.41	42.71	0.13	NS
First	185.20^{d}	190.48^{c}	194.79^{b}	199.53^{a}	1.28	3.79
Second	403.49^{d}	410.82^{c}	419.75^{b}	429.12^{a}	1.67	4.95
Third	726.55^{d}	737.5^{c}	751.56^{b}	764.32^{a}	2.31	6.86
Fourth	$1,122.24^{d}$	$1,140.05^{c}$	$1,157.70^{b}$	$1,176.80^{a}$	2.64	7.85
Fifth	$1,552.71^{d}$	$1,572.71^{c}$	$1,593.68^{b}$	$1,618.32^{a}$	3.06	9.08
Sixth (Final Weight)	$2,076.97^{d}$	$2,100.82^{c}$	$2,124.64^{b}$	$2,152.29^{a}$	3.57	10.60

Table.3 Effect of supplementation of Multienzymes constant levels of Prebiotics and Probiotics on weekly body weight gain of broilers

Weeks	Treatments				Mean SE (±)	CD @ 5%
	T0	T1	T2	T3		
First	142.71^{d}	147.94^{c}	152.38^{b}	156.82^{a}	1.22	3.62
Second	218.26^{c}	220.34^{c}	224.96^{b}	229.59^{a}	1.30	3.87
Third	323.07^{b}	326.68^{b}	331.81^{a}	335.20^{a}	1.35	4.00
Fourth	395.68^{c}	402.55^{b}	406.15^{b}	412.48^{a}	1.35	4.01
Fifth	430.48^{b}	432.67^{b}	435.98^{b}	441.52^{a}	1.41	4.19
Sixth	524.26^{b}	528.10^{b}	530.96^{ab}	533.97^{a}	1.88	5.57

Table.4 Effect of supplementation of Multienzymes constant levels of Prebiotics and Probiotics on cumulative feed intake of broilers

Weeks	Treatments				Mean SE (±)	CD @ 5%
	T0	T1	T2	T3		
First	179.39^{c}	184.56^{b}	190.28^{a}	194.43^{a}	1.72	5.12
Second	560.44	563.03	564.10	566.82	1.89	NS
Third	1,164.66	1,165.33	1,165.94	1,163.62	2.48	NS
Fourth	1,948.73^{a}	1,946.98^{a}	1,945.14^{ac}	1,938.73^{c}	2.41	7.17
Fifth	2,766.72^{a}	2,759.65^{ab}	2,753.81^{b}	2,744.45^{c}	2.63	7.82
Sixth	3,681.97^{a}	3,671.39^{b}	3,662.92^{b}	3,651.52^{c}	3.11	9.24

Table.5 Effect of supplementation of Multienzymes constant levels of Prebiotics and Probiotics on weekly feed intake of broilers

Weeks	Treatments				Mean SE (±)	CD @ 5%
	T0	T1	T2	T3		
First	179.39^{c}	184.56^{b}	190.28^{a}	194.43^{a}	1.72	5.12
Second	381.04^{a}	378.46^{a}	373.82^{bc}	372.39^{c}	0.97	2.87
Third	604.23^{a}	602.30^{a}	601.83^{ab}	596.80^{b}	1.58	4.68
Fourth	784.06^{a}	781.65^{ab}	779.21^{b}	775.11^{c}	1.19	3.52
Fifth	817.99^{a}	812.67^{b}	808.66^{c}	805.72^{c}	1.33	3.96
Sixth	915.25^{a}	911.75^{b}	909.12^{bc}	907.08^{c}	1.13	3.37

Table.6 Effect of supplementation of Multienzymes constant levels of Prebiotics and Probiotics on weekly feed conversion ratio of broilers

Weeks	Treatments				Mean SE (±)	CD @ 5%
	T0	T1	T2	T3		
First	1.26	1.25	1.25	1.24	0.01	NS
Second	1.75^{a}	1.72^{a}	1.66^{b}	1.62^{c}	0.01	0.03
Third	1.87^{a}	1.84^{ab}	1.82^{b}	1.78^{c}	0.01	0.03
Fourth	1.98^{a}	1.94^{b}	1.92^{b}	1.88^{c}	0.01	0.02
Fifth	1.90^{a}	1.88^{ab}	1.86^{b}	1.82^{c}	0.01	0.02
Sixth	1.75^{a}	1.73^{ab}	1.71^{bc}	1.70^{c}	0.01	0.02
Overall	1.75^{a}	1.73^{ab}	1.70^{abc}	1.67^{c}	0.01	0.05

Feed intake and feed efficiency

Cumulative feed intake

The average feed intake of experimental broiler chicks was recorded at weekly interval throughout the experimental period of 6 weeks. The average weekly feed intake of broiler chicks represented in Table 4. Responses to enzyme supplementation depend on the bird's age, which is apparently related to both the type of gut microflora present and the physiology of the bird. In old birds, due to enhanced fermentation capacity of the microflora in their intestines, have a greater capacity to deal with the effects of high viscosity.

Weekly feed intake

The weekly feed intake of experimental broiler chicks was recorded at weekly interval throughout the experimental period of 6 weeks. The average weekly feed intake of broiler chicks represented in Table 5. During sixth week, weekly feed intake of the birds during experimental period was higher in treatment T_0 (915.25) followed by treatment T_1, T_2 and T_3 groups, respectively.

Increased feed intake in the 0.3 per cent Multi-enzymes with 0.05 per cent Prebiotics and 0.01 per cent Probiotics supplemented groups can be attributed to changes in feed taste with increased metabolic process.

Our findings were in contradictory to Goli and Shahryar (2015), who recorded the lowest feed consumption in control group while the highest were obtained in groups that fed with multi enzyme supplementation. Also, Anuradha and Roy (2015) recorded significant increase in feed consumption when different enzyme preparations are supplemented in broiler diets.

Feed conversion ratio

The mean weekly feed conversion ratio and their standard error at different weeks of age are presented in Table 6. The overall feed conversion ratio for treatments T_0, T_1, T_2 and T_3 were 1.75, 1.73, 1.70 and 1.67, respectively. Statistically better FCR was recorded in T_3 (1.67) treatment as compared to other treatments. Our findings were concurrent with Chimote *et al.,* (2009) observed that the body weight gain and feed conversion efficiency was significantly ($P<0.01$) better in Probiotic and enzyme fed groups. Alkhalf *et al.,* (2010) showed that improved feed conversion was noticed in birds fed diet supplemented with probiotic. But Goli and Shahryar (2015) observed poor FCR in control group and best FCR (lowest) were in groups that were fed only multi enzymes.

The results of Thorat *et al.,* (2015) indicated that multi-enzyme supplementation as growth promoter improved the growth performance of broilers significantly followed by Prebiotics but not Probiotics as compared to control group.

In conclusion the supplementation of multi-enzymes @ 0.3 per cent with 0.5 per cent Prebiotics, 0.1 per cent Probiotics in the feed of broiler birds caused significant increase in live weight, body weight gain of the birds than other treatments i.e. Multienzyme @ 0, 0.1 and 0.2 per cent with constant levels of Prebiotics (Fructooligosaccharides @ 0.05%) and Probiotics (Saccharomyces cervisiae @ 0.01 %) by reducing feed intake. The results of the present study showed that Probiotic plus Prebiotic and multi-enzymes supplementation significantly increased body weights in 42 days. The synergistic effects between Probiotics, Prebiotics and multienzymes should be further investigated on a large scale, suitable commercial

combinations and levels should be determined, and these results should be incorporated in practice.

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