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Effect of probiotic supplementation on growth performance, feed efficiency and carcass quality of broilers

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ABSTRACT : An experiment was conducted and evaluated the influence of probiotic supplementation on growth, feed efficiency and carcass quality of broilers. The probiotic having different strains of beneficial micro-organisms *viz., Lactobacillus acidophilus, Lactobacillus plantarum, Lactobacillus bulgaricus, Pediococcus acidilactici, Lactobacillus casei, Streptococcus thermophilus, Streptococcus faecium, Bifidobacterium bifidum* was used for the study. Eighty day old (vencobb-400) chicks were distributed into four treatment groups T_0, T_1, T_2 and T_3 having 20 chicks in each group. The dietary treatments were planned as a control *i.e.* without probiotic (T_0), with probiotic powder @ 0.25g/lit.(T_1), 0.50g/lit.(T_2), 0.75g/lit. (T_3), respectively. The gain in body weight and feed conversion of probiotic fed groups were superior ($p<0.05$) compared to the control group in the 4th, 5th and 6th weeks. The highest feed consumption was noticed in T_0 treatment. Statistically the difference in proximate composition of meat was non-significant which indicated that though the multistrain probiotic powder improved FCR but it does not affect the meat quality. It is, therefore, concluded that supplementation of multistrain probiotic powder through drinking water at the rate 0.50g/lit. might be beneficial for broilers.

KEY WORDS : Probiotic, Broilers, Growth, Carcass

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INTRODUCTION

Poultry productions act as a source of income to the farmers and also supply good quality proteins through egg and meat. The success of poultry production depends primarily on the quality of the bird employed, comfortable environment and provision for nutritious feed, the last being most expensive of all other inputs deserves, so it benefiting attention (Panda, 2002). Besides a liberal supply of well-balanced feed, its effective utilization by bird is equally important. Thus, the major objective of poultry farming is to increase the profit margin in poultry business by improving feed efficiency and growth rate.

Recent trend in broiler production is to offer diets containing feed additives to improve feed efficiency and obtain maximum returns in shortest possible time. Various types of feed additives (antibiotics, enzymes, hormones, prebiotics, probiotics, herbal products, etc.) are used as growth stimulants in poultry production.

The most commonly used feed additive such as antibiotics could not be continued looking to the danger of drug resistance and health hazards in human beings due to residual effect through food chain. Therefore, the use of probiotic as a substitute to antibiotics in poultry

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has become an area of great interest. The extensive uses of antibiotics in animal farms to promote growth rate, increasing feed efficiency and prevention of intestinal infections have led to the development of antibiotic-resistant bacteria in the gastrointestinal tract and drug residuals in meat. The use of probiotics in order to competitively exclude the colonization of intestinal pathogens has been proposed for poultry, especially after some countries banned certain antibiotics being frequently included in rations as growth promoters. Probiotic are defined as viable micro-organisms bacteria or yeasts) that exhibit a beneficial effect on the health of the host when they are ingested (Salminen *et al.*,1998).

Today, probiotic are used as health supplements in food and feeds and they are replacing the use of antibiotic growth promoters or chemical supplements. Probiotic based on natural conditions of micro-organisms in the digestive tract and balance in nature made and as growth stimulants are used in animal and poultry feed. The present study was conducted to study the effect of probiotic feeding on performance, feed efficiency and carcass quality of broiler chickens.

MATERIAL AND METHODS

Eighty day old (vencobb-400) chicks were equally distributed into four treatment groups T_0, T_1, T_2 and T_3 having 20 chicks in each group. Probiotic powder was added in drinking water at different levels. The dietary treatments were planned as a control (T_0), with Probiotic powder @ 0.25g/lit. (T_1), 0.50g/lit. (T_2), 0.75g/lit. (T_3), respectively and raised under deep litter system. The birds were allowed to have free access to a starter ration during the first 3 weeks and then to a finisher ration for subsequent 3 weeks (Table 1) and free access to water. The probiotic used in the experiment was having different strains of beneficial micro-organisms namely *Lactobacillus acidophilus, Lactobacillus plantarum, Lactobacillus bulgaricus, Pediococcus acidilactici, Lactobacillus casei, Streptococcus thermophilus, Streptococcus faecium, Bifidobacterium bifidum.* Body weight gain and feed consumption were monitored weekly and feed conversion rate was calculated as feed consumed per unit of weight gain. At the end of the sixth week, 10 chickens from each group were randomly selected and slaughtered by following proper slaughtering procedure the proximate composition (AOAC, 1994) of carcass were determined. The data were evaluated by using Completely Randomized Design as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Composition of experimental ration :

The proximate composition of experimental broiler starter and finisher rations are presented in Table 1. It was observed that experimental broiler rations contained adequate nutrients for growth as per BIS (1992). The crude protein and calculated metabolizable energy (ME) of the starter ration was 23 per cent and 2863.81 Kcal/kg, respectively. The crude protein and calculated metabolizable energy (ME) of the finisher ration was 19.9 per cent and 2939.75 Kcal/kg, respectively.

Growth performance :

The probiotic supplementation had significantly higher ($P<0.05$) live weight gain at age 4th to 6th weeks. The higher body weight gain was observed at 4th and 5th weeks of age in T_2 treatment as compared to other treatments. The average weekly body weight gain at the age of 6th

Table 1 : Per cent proximate chemical composition of experimental ration (on DM basis)

Nutrients	Broiler ration	
	Starter	Finisher
Crude protein	23.0	20.0
Crude fibre	4.60	3.78
Ether extract	4.80	4.3
Total ash	7.20	6.85
Nitrogen free extract	60.40	65.15
Acid insoluble ash	1.25	1.44
ME (Kcal/kg)	2863.81	2939.75

week of age were, 447.10, 513.40, 465.25 and 510.31 g in T_0, T_1, T_2, and T_3 treatments groups, respectively. Averaged higher weight gain was observed in treatment T_2 than the T_3, T_2 and control though at end of sixth week the treatment T_0 and T_2 likewise T_1 and T_3 were at par to each other. The effect of probiotic supplementation on broiler production might be favourable. Improvement in live weight could be ascribed to improved digestion and absorption of nutrients in the digestive tract due to the presence of amylase derived from the lactobacilli. Bhatt (1993) reported significantly ($P \leq 0.05$) higher live weight gains in broiler stock supplemented with *Streptococcus lactis and Saccharomyces cerevisiae.* Manickam *et al.* (1994) recorded a highly significant ($P \leq 0.01$) difference in weight gain between control and experimental group of broiler when *Lactobacillus sporogenes* based probiotic was given at 1 g per liter of drinking water for a period of 0-6 weeks. Jin *et al.* (1996) reported significant ($P \leq 0.05$) higher weight gain in broilers given diets supplemented with *Bacillus subtilis* and *Lactobacillus* culture. Hamid *et al.* (1996) reported that feeding of broiler chicks with diets supplemented with *L. acidophilus* culture showed higher gain in weight (945.5g) against control (773.5g). Ladukar *et al.* (2001) conducted an experiment to study the effect of five commercial probiotics on the growth performance of broiler chicks and observed no significant ($P \leq 0.05$) difference in live weight gain.

Feed intake:

At first week of age feed consumption in all treatment was non-significant. The average feed consumption in T_1 treatment was significantly ($P < 0.01$) higher than T_0 and T_3 were at par at 2nd week of age. The average feed consumption at 3rd week of age showed that control group had higher feed intake over T_1 and T_3

Table 2 : Effect of probiotic on performance of chickens

Treatment	Age (weeks)					
	1st	2nd	3rd	4th	5th	6th
Body weight gain (g)						
Control	75.55	115.25	305.56	403.04^{b}	540.37^{bc}	447.10^{a}
T_1	74.21	116.71	319.50	388.01^{a}	526.45^{ab}	513.40^{b}
T_2	78.53	117.55	321.35	428.85^{b}	561.90^{c}	465.25^{a}
T_3	77.75	108.20	310.02	403.15^{b}	507.12^{a}	501.31^{b}
Mean	76.50	114.43	314.09	405.95	534.09	481.76
S.E.±	1.87	5.44	9.61	9.96	9.49	9.49
C.D. (P=0.05)	NS	NS	NS	28.05	26.73	26.73
Feed intake (g/chickens)						
Control	138.30	224.15^{bc}	541.53^{b}	723.91^{b}	966.80^{c}	1214.6^{b}
T_1	136.15	229.04^{c}	522.65^{a}	721.80^{b}	942.31^{b}	1244.4^{c}
T_2	134.31	214.55^{a}	507.55^{a}	704.10^{a}	912.70^{a}	1125.4^{a}
T_3	143.05	221.05^{b}	519.65^{a}	722.85^{b}	941.71^{b}	1238.7^{c}
Mean	137.95	220.71	522.81	718.14	940.73	1205.7
S.E.±	3.04	2.36	6.15	4.21	10.18	6.65
C.D. (P=0.05)	NS	6.65	17.33	11.86	22.66	18.74
Feed conversion ratio (Feed/gain)						
Control	1.83	1.94	1.77^{b}	1.79^{b}	1.78^{b}	2.71^{b}
T_1	1.83	1.96	1.65^{ab}	1.85^{b}	1.78^{b}	2.42^{a}
T_2	1.71	1.82	1.57^{a}	1.64^{a}	1.62^{a}	2.41^{a}
T_3	1.82	1.98	1.67^{a}	1.79^{b}	1.85^{b}	2.47^{a}
Mean	1.79	1.92	1.66	1.76	1.75	2.50
S.E.±	0.06	0.11	0.05	0.05	0.04	0.06
C.D. (P=0.05)	NS	NS	0.14	0.15	0.11	0.16

Mean value with different superscript differ significantly (P<0.05) NS= Non-significant

treatments, whereas the treatment T_1, T_2 and T_3 were at par. The numerical higher feed consumption was observed in control (723.91 g) followed by T_3, T_1 and T_2 at 4th week of age. It was observed at 5th week of age that treatment control and T_2 were differ significantly ($P < 0.01$) and treatment T_1 and T_3 were at par. At 6th week of age for treatment T_0, T_1, T_2 and T_3 were 1214.60, 1244.40, 1125.40 and 1238.70 g, respectively. The higher feed consumption was observed in treatment T_1 followed by T_3, control and T_2. Statistically it was observed that treatment T_1 and T_3 were at par (Table 2).

The broiler chicks fed without probiotic (control) consumed more quantity of feed (3809.15 g) as compared to treatment T_1 (3796.4 g) and T_3 (3780.4 g), while treatment T_2 consumed lower feed (3598.50 g) than other treatments. No specific feed consumption pattern was observed during the experimental period in all treatments. Similar trend was observed by Yadav *et al.* (1994). Gohain and Sapcota (1998) reported that feeding of probiotic (*L. acidophilus, Streptococcus faecium*) at 0.05 per cent level reduced the feed intake (3797.11 g) as compared to control (3901.69 g) in broiler but did not differ significantly ($P < 0.05$). The higher feed intake at higher probiotic level (0.075%) was also reported by Pande (1995). The non-significant difference among broiler fed probiotic and control was reported by Sarkar *et al*. (1996); Singh and Sharma (1996) and Saha *et al.* (1999).

Feed conversion ratio:

Numerically better FCR in first and second week was observed in T_2 treatment than other treatments though all treatment was non-significant. Statistically FCR in third week, was found that treatment T_2 was significantly ($P<0.05$) superior in feed conversion over T_0, whereas probiotic fed groups were at par. The average FCR for fourth and fifth week of age for treatment T_0 (control), T_1, T_2 and T_3 were given table showed that treatment T_2 differ significantly ($P<0.01$) better than T_0, and T_3, whereas treatment T_0, T_1 and T_3 were at par. At the end of sixth week FCR of treatment T_2 (0.50g) was significantly ($P<0.01$) better than other probiotic fed groups T_1 (0.25), T_3 (0.75 g probiotic) and were superior than control.

The improvement in feed conversion ratio indicated that treated birds had better feed utilization than control birds might be due to the presence of multi-strain probiotic in the diet. The significant improvement of FCR in feeding probiotic was in agreement with Jin *et al.* (1996) who reported improved feed: gain ratio in broilers given *Lactobacillus* in drinking water. Hertrampf (1979) reported that probiotics had been successful in improving feed conversion efficiency in broilers. Cavazzoni *et al.* (1993) reported 6 per cent improvement in feed conversion efficiency in broilers fed diet supplemented with probiotics (*Bacillus coagulans*) as compared to control.

Proximate composition of meat :

The effect of probiotic supplementation on proximate composition of meat from broilers is presented in Table 3. The per cent moisture, protein, fat, and ash content under each treatment were 72.11, 73.09, 73.01 and 72.82 percent moisture, 1.6, 1.11, 2.02 and 2.08 per cent ash. 21.33, 22.37, 20.00 and 20.47 per cent protein. 3.52, 3.43, 3.32 and 2.45 per cent fat. 48.57, 49.69, 48.83 and 49.51 per cent NFE in T_0, T_1, T_2 and T_3 group, respectively. Statistically the difference in proximate composition of meat was non-significant which indicated that though the multistrain probiotic powder improved FCR but it does not affect the meat quality. These results were in agreement with the findings of Anjumn *et al*. (2005). Pietra (2001) and Kumprecht and Zobac (1998) reported that the higher protein content in chicken given probiotics.

Conclusion:

The supplementation of 0.50 g/lit of multistrain probiotic powder in the diet of broilers through drinking water, significantly improved the live weight and feed conversion ratio without affecting the meat quality.

Table 3 : Effect of probiotic on proximate composition of chicken meat

Treatment/ parameter (%)	T_0	T_1	T_2	T_3	C.D.	S.E. ±
Moisture	72.11	73.09	73.01	72.82	NS	0.81
Crude protein	21.33	22.37	20.00	20.47	NS	0.48
Crude fat	3.52	3.43	3.32	2.45	NS	0.75
Ash	1.6	1.11	2.02	2.08	NS	0.24

NS= Non-significant

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