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Effect of feeding probiotics on body weight gain and economics importance in broiler chicks

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Abstract
One hundred twenty, one-day-old male broiler chicks (Cobb 400 strain), were randomly assigned to 4 treatments (30 birds/treatment). Treatment groups were; Control group in Standard ration, probiotic in Standard ration0.1% (treatment 2), probiotic in Standard ration 0.2% (treatment 3) and probiotic in Standard ration0.3% (treatment 4). Chicks were reared for 42 days. Body weight, feed consumption and feed conversion were weekly determined. Probiotic have been used in poultry industry for decades to promote growth and protect animals from diseases, followed by various side effects. In efforts of searching for a better alternative, probiotic is of extensive attention. The results of this study indicated that feed consumption for the entire period (up to 6 weeks) were significantly (P<0.05) increased in the treatments 1 and 4, when probiotic was added at a rate of 0 and 0.3%, compared with the other treatments (2 and 3). Body weight gain for the entire period (up to 6 weeks) were significantly (P<0.05) increased in the treatments 2, 3 and 4, when probiotic was added at a rate of 0.1, 0.2 and 0.3%, compared with the other treatments (1). These birds also had a significantly (P<0.05) higher feed conversion ratio than others and finally the lowest feed cost per kg of body weight was observed in the group containing probiotic.

Keywords: probiotics, growth performance

Introduction
In India, there is a huge gap between demand and availability of poultry feeds in general and energy feeds in particular. The unusually high price of grain in these days has induced the poultry farmers to find ways for their substitutes i.e. traditionally groundnut cake, fish meal, wheat and maize grain. Maize is used as a main energy source in poultry diets. (Raman *et al.* 2010) [1]. The poultry meat production is estimated to be about 2.47 million tonnes. The current per capita availability of eggs is around 55 eggs per year. Exports of poultry products are currently at around 457.82 crore in 2011-12 as per the report of Agricultural and Processed Food Products Export Development Authority (APEDA) Annual Report 2012-13 [18].

Probiotics have been defined as "Live microorganisms(bacteria or yeasts), which when ingested or locally applied in sufficient numbers confer one or more specified demonstrated health benefits for the host"(Anil *et al*., 2007) [2].

He suggested that *Lactobacilli* in yogurt could have a positive effect on the intestinal micro flora, which meant a lot to human health and longevity. The poultry industry during the past two decades has been one of the most dynamic and ever expanding sectors in the world [3] (Alkhalf *et al*., 2010) [13]. For about fifty years, antibiotics have been used as feed additives in poultry industry to promote animal growth and protect animal against infection of pathogenic microorganisms (Ferket *et al*., 2002) [4].

However, with increasing problems brought by abuse of antibiotic, such as antibiotic resistance, there are bans on sub therapeutic antibiotic usage in the poultry industry in Europe (Edens 2003) [5].

Methods and Materials
Four commercial probiotic products obtained from research cooperation base of Sardar Vallabhbhai Patel University of Agriculture & Technology Meerut Probioticwere used in this study.

Table 1: Composition of the basal diet

Ingredient	Starter ration	Finisher ration
Composition g/kg what values	Starter 0 - 21 days	Finisher 22 - 42 days
Yellow maize	60.00	61.50
Wheat bran	6.00	10.75
Soyabeen meal	22.00	18.50
Fat	1.00	1.00
Fish meal	8.00	2.25
Mineral mixture	2.00	2.25
Comman salt	0.25	0.25
Vitamin mixture	0.25	0.50
L-lysine	0.15	0.10
DL-methonine	0.10	0.15
Energy	3.244kcal	Energy
Carbohydrate	0.791g	Carbohydrate
Protein	0.008g	Protein
Fat	0.005g	Fat
Lactobacillus acidophilus	1.25 billion	*Lactobacillus acidophilus*
Bacillus longum	0.125 billion	*Bacillus longum*
Bacillus bifidium	0.125 billion	*Bacillus bifidium*
Bacillus lactis	1.0 billion	*Bacillus lactis*

Experimental design and husbandry

All practice in the process of this study concerning animal care followed principles required by the university. One hundred Twenty-one-day-old male broiler chicks Cobb 400 of synthetic strain were selected randomly and used for the study purpose. Feed consumption and growth performance data will be collected weekly. Each with no significant differences were assigned at random to4 experimental groups with each group consisted of 30 birds and raised floor pens (0.90 m^2/bird) for 6-7 Weekes.). Treatment groups were; Control group in Standard ration (treatment 1), probiotic in Standard ration0.1% (treatment 2), probiotic in Standard ration 0.2% (treatment 3) and probiotic in Standard ration0.3% (treatment 4). Chicks were reared for 42 days. Chicks were vaccinated at hatch for Marek's, Newcastle and Infectious Bronchitis Disease.

Growth performance

All birds in each group were weighed individually at 07, 14, 21, 28, 35 and 42 days of age. Daily weight gain (DWG) in overall period was calculated. The chicks were offered sufficient quantities of the starter ration from 0-6 weeks of age. For the first three days of brooding feed was provided on the newspaper spread on floor and thereafter, linear chick feeders were used up to 14 days and weighed at weekly interval. After 20 days (During the finishing phase) finisher ration were used. Fresh and clean drinking water was available daily in the morning and evening to the birds throughout the experimental period.

Statistical analysis

Each individual broiler in each group was handled as one experimental unit. Data were subjected to two-way analysis of variance (ANOVA) using the DMRT 19.0 (1995, SPSS Inc., USA).

Results and Discussion

Feed consumption up to 6 weeks of age

The feed consumption up to 6 weeks of age of all the treatment groups of broiler chicks was reported in table 2. The average feed consumption was found 3373.40 ± 1.246, 3322.40 ± 0.887g, 3370.90 ± 1.123g and 3402.90 ± 0.679g in T_1, T_2, T_3 and T_4 group respectively (Table 2). Overall average feed consumption for all the treatment groups was 3367.4± 0.983 g up to six weeks of age (Table 2). The feed consumption up to 6 weeks of age ranged from 3322.40 ± 0.887 g (T_2 group) to 3402.90 ± 0.679 g (T_4 group) (Table 2). The feed consumption of up to 6 weeks of broiler chicks of all the treatment groups was differ significantly ($P<0.05$) each other groups (Table 2 and ANOVA).

Table 2. Feed Consumption up to 6 weeks of age (gram)

Treatments	No. of Replication			Mean	SEM
	R1*	R2*	R3*		
T1	3376.12±1.139	3371.82±1.301	3372.26±1.298	3373.40^c	1.246
T2	3324.12±0.810	3320.98±0.932	3322.1±0.919	3322.40^a	0.887
T3	3368.98±1.014	3371.65±1.265	3372.07±1.090	3370.90^b	1.123
T4	3403.12±0.694	3401.95±0.651	3403.63±0.692	3402.90^d	0.679
CD	3.267 Overall mean			3367.4	0.983

* (n=10 chicks) a, b, c, d: Means with different superscripts in each column Differ significantly ($p<0.05$).

* The results are reported as Mean ± SEM

Sohail *et al.* (2012) [6] reported average feed consumption ranged from 3214.5 g to 3065.00 g per chicks fed different diets, while average value of feed consumption in present study was 3699.92 ± 13.837 g which is in between the above value. Hence our results are in agreement with above study. Mountzouris *et al.* (2009) [7] who supplemented probiotic (10^8, 10^9, 10^{10}cfu probiotic/kg) in broiler chicks increase the feed consumption in supplemented (treatment) group 4022 ± 30.80 g in comparison to non supplemented group (control). Shareef *et al.* (2009) [8] reported the average feed consumption during 0-6 week of age for commercial broiler ranged from 2506.0g to 2812.0g with FCR 1.90. The average feed consumption

was lower than present investigation. This may be due to effect of strain of broilers used in experiment and further may be effect of diet composition. Habibi *et al.* (2013) [9] reported average feed consumption up to 6 week of ranges from 3445.4 to 3483.0 g per chicks with average value 3460.96g. Tabidi *et al.* (2013) [10] reported the average feed consumption during 0-6 week of age for commercial broiler ranged from 1789.33 g to 2012.0 g. The average feed consumption was lower than present investigation. This may be due to effect of strain of broilers used in experiment and further may be effect of diet composition. Mansoub, (2010) [11] who supplemented probiotic T3 group (0.5% L. acidophilus) in broiler chicks increase the feed consumption in supplemented (treatment) group 3700.07 ± 88.58g in comparison to non-supplemented group (control). Amerah *et al.*, (2013) [12] who reported that dietary supplementation of broilers diets with probiotic did not affect the feed consumption 4664 ± 38 g compared to the control group. Midilli, *et al.* (2008) [13] who supplemented probiotic (T2 0.05%, 0.05% Probiotic and Bio-moss 0.1%) in broiler chicks decrease the feed consumption in supplemented (treatment) group 4142 ± 36.8g in comparison to non-supplemented group (control).

Body weight gain up to 6 weeks of age

The body weight gain up to 6 weeks of age of all the treatment groups of broiler chicks was presented in table 3. The average body weight gain was found 2149.10 ± 1.683g, 2224.90 ± 2.999g, 2330.70 ± 0.649g and 2499.30 ± 1.938g in T_1, T_2, T_3 andT_4 group respectively (Table 3). Overall average body weight gain for all the treatment groups was 2301.25 ± 1.817 g up to 6 weeks of age (Table 3). The body weight gain up to 6 weeks of age ranged from 2149.10 ± 1.683 g (T_1 group) to 2499.30 ± 1.938 g (T_4 group). The body weight gain of up to 6 weeks of broiler chicks of all the treatment groups was differ significantly (P<0.05) each other (Table 3 and ANOVA).

Table 3: Body Weight Gain up to 6weeks of age (gram)

Treatments	No. of Replication			Mean	SEM
	R1*	R2*	R3*		
T1	2146.95±1.601	2152.32±1.765	2147.73±1.683	2149.10^a	1.683
T2	2229.10±2.897	2226.52±3.045	2219.08±3.055	2224.90^b	2.999
T3	2329.63±0.695	2331.52±0.612	2330.95±0.640	2330.70^c	0.649
T4	2495.62±1.060	2499.98±2.395	2502.30±2.359	2499.30^d	1.938
CD	6.619 Overall mean			2301.25	1.817

* (n=10 chicks) a, b, c, d: Means with different superscripts in each column Differ significantly (p<0.05).
*The results are reported as Mean ± SEM

Average body weight gain of broiler chicks up to 6 week of age for the group fed diet T_1, T_2, T_3 and T_4 was found 2149.1 ± 22.630 g, 2224.9 ± 20.940 g, 2331.7 ± 19.548 g and 2499.3 ± 12.539 g respectively. The overall average weight gains for T_1, T_2, T_3, and T_4 were found 2301.25 ± 18.914 g, up to six week of age. Table also showed that body weight gain up to 6 week of age ranged from 2499.3 ± 12.539 g (T_4 group) to 2149.1 ± 22.630 g (T_1 group), Significant differences (P<0.05) exist in body weight gain of broiler chicks among different treatment of diet fed to broiler chickens. The overall body weight gain up to 6 week of age was higher for the group fed diet T_4. Since there was inclusion of 0.3% probiotic in diet T_4. The growth may be due to inclusion probiotic. Mountzouris *et al.* (2009) [14] who supplemented probiotic (10^8, 10^9, 10^{10}cfu probiotic/kg) in broiler chicks similar the body weight gain supplemented in (treatment) group 2230 ± 17.40 g in comparision to non-supplemented group (control). Dizaji*et al.* (2012) [15] who supplemented probiotic Protexin (150gr/ton of the starter diets and 50gr/ton of the finisher diets) in broiler chicks lower the body weight gain supplemented in (treatment) group 2075.57 ± 23.87 g in comparison to non-supplemented group (control). Amerah *et al.*, (2013) [12] who supplemented probiotic PRIMALAC (0 and 900 g/ton and prebiotic FERMACTO (0, 1000 and 2000 g/ton) in broiler chicks increase the body weight gain supplemented in (treatment) group 2343.67 ± 32.89 g in comparison to non-supplemented group (control). Tabidi *et al.* (2013) [10]. Who supplemented probiotic (0.5 ml of probiotic per one liter of water for the whole growth period) in broiler chicks lower the body weight gain supplemented in (treatment) group 1748.15 ± 9.68 g in comparison to non-supplemented group (control). Lokman *et al.* (2012) [16] conducted experiment on growth performance of broiler, body weight gain was reported from 1919.0 to 1770.0 g during 0-6 weeks of age with average weight gain was 1774.53 g. Mean value was lower than present investigation (1872.95 ± 4.008 g). This difference can be contributed by genetically potential of chicks. Midilli *et al.* (2008) [13] who supplemented probiotic (T2 0.05%, 0.05% Probiotic and Bio-moss 0.1%) in broiler chicks increase the body weight gain supplemented in (treatment) group 2274 ± 18.6g in comparison to non supplemented group (control).

Feed conversion ratio (FCR) up to 6 weeks of age

The feed conversion ratio up to 6 weeks of age of all the treatment groups of broiler chicks was reported in Table 4. The average feed conversion ratio was found 1.570 ± 0.034, 1.495 ± 0.096, 1.449 ± 0.010 and 1.362 ± 0.042 in T_1, T_2, T_3 and T_4 group respectively (Table 4). Overall average feed conversion ratio (FCR) for all the treatment groups was 1.470 ± 0.045 up to six weeks of age (Table 4). The feed conversion ratio (FCR) at up to 6 weeks of age ranged from 1.362 ± 0.042 (T_4 group) to 1.576 ± 0.034 (T_1 group) (Table 4). The feed conversion ratio (FCR) of up to 6 weeks of broiler chicks of all the treatment groups was differ significantly (P<0.05) to each other except T_1 vs. T_2, T_2 vs. T_3 andT_3 vs. T_4 (Table 4 and ANOVA).

Table 4. Feed Conversion ratio up to 6 weeks of age

Treatments	No. of Replication			Mean	SEM
	R1*	R2*	R3*		
T1	1.526±0.036	1.562±0.033	1.64±0.033	1.576^c	0.034
T2	1.321±0.086	1.510±0.095	1.654±0.107	1.495^{bc}	0.096
T3	1.432±0.009	1.450±0.010	1.465±0.011	1.449^{ab}	0..010
T4	1.279±0.036	1.421±0.044	1.370±0.045	1.362^a	0.042
CD	N.S. Overall mean			1.470	0.045

The feed conversion ratio up to 6 weeks of age of all the treatment groups of broiler chicks was reported in Table 4.

Average feed conversion ratio for growing chicks was varies from 2.03 to 2.28 as reported by Lokman *et al.* (2003) [16]. In present investigation average value of feed conversion ratio ranged from 1.757 to 1.945 which are lower than reported by above scientist this difference may be due to difference in composition of diet or it may be due to genetic improvement in chicks. Shareef *et al.* (2009) [8] reported feed conversion ratio value ranges from 1.86 to 1.95. These results are in agreement with present experiment. Shabani Roozbeh *et al.* (2012) [17] who found that using dietary supplementation of probiotics alone in broilers had a significant positive effect on the feed conversion ratio compared to the control. Dizaji *et al.* (2012) [15] reported that feed conversion ratio improved by the supplementation of dietary probiotic Protexin (150gr/ton of the starter diets and 50gr/ton of the finisher diets) 1.925 ± 0.033 compared to the control group. Mansoub, (2010) [11] who found that using dietary supplementation of probiotics alone in broilers had a significant positive effect on the feed conversion ratio compared to the control. Tabidi *et al.* (2013) [10] reported that feed conversion ratio improved by the supplementation of dietary probiotic (0.5 ml of probiotic per one liter of water for the whole growth period) 2.45 ± 0.021 compared to the control group. Amerah *et al.*, (2013) [12] reported that feed conversion ratio improved by the supplementation of dietary probiotic (without or with 1.5 × 10^5 cfu/g feed) 1.680 ± 0.018 compared to the control group. Midilli *et al.* (2008) reported that feed conversion ratio low by the supplementation of dietary probiotic (T2 0.05%, 0.05% Probiotic and Bio-moss 0.1%) 1.82 ± 0.1 compared to the control group.

Economics of broiler production

Broiler production must be a profitable enterprise. Therefore, it requires judicious ration for birds because it contribute over 70% of the total cost of bird production. Therefore, an attempt was made to lower the feed cost of bird production. The total expenditure includes the cost of day old broiler chicks, electricity charges, labor charges and the total feed required to produce live weight gain of the broiler.

The cost of different experiment diets (starter and finisher) as shown in table 5 has been calculated on the basis of the current prices of the feed ingredients available during the investigation (2013-2014). The input-output of broiler production are given table.

Table 5. Economics (Rs) of Feeding Probiotic Supplementation in Broiler Chicks.

Particulars	T1 (Control)	Probiotics%		
		T2	T3	T4
		0.1	0.2	0.3
Cost/Bird (Rs.)	28	28	28	28
Feed cost per bird (Rs.)	70	71	74	76
Probiotic (Rs.)	-	2.25	4.50	6.75
Labour Cost/ Bird (Rs.)	10	10	10	10
Miscellaneous (Rs.)	2.5	2.5	2.5	2.5
Total Cost of Production (Rs.)	110.5	113.75	119.00	123.25
Sale / Bird (Rs.)	125	135	145	155
Sale of other (Rs.)	1.5	1.5	1.5	1.5
Net Income (Rs.)	126.5	136.5	146.5	156.5
Net Profit/ Bird (Rs.)	16	22.75	27.50	33.25
Cost Benefit Ratio (Rs.)	1.10	1.14	1.18	2.11

Conclusion

In last decade, there is a renewed interest in the development of Probiotics which has underlined understanding the mechanism of action rather than blind faith in people and stories, as in the past. Several approaches in exploiting the Probiotics wealth of the world in phytomedicine have explored many phytochemicals from variety of plants. Nonetheless, even with the limited reports on mechanism of activity it has become obvious that numerous mechanisms would have been involved in different activities of a given Probiotics. It could be concluded that, under the condition of the present study, Probiotics at 0.3% dietary inclusion are more efficient than control group on improving broiler performance. Therefore, dietary inclusion of Probiotics in broiler diets is highly recommended, it will be interesting to try different inclusion levels of Probiotics since there was no detrimental effect recorded both health wise and performance.

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