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ORIGINAL ARTICLE

Influence of Probiotic (Floraboost-Ad_3) in Broiler Chicken Production and Economics of Rearing

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ABSTRACT
The present research work, entitled "Influence of probiotic (flora boost-AD_3) on broiler chicken production and economics of rearing," was postulated with the aim to find out the effects of dietary supplementation of probiotics at different levels on the performance in terms of growth, feed intake, carcass characteristics, overall performance, and cost of rearing broiler chickens. For this, a total of 120 broiler chicks were divided randomly into four treatments with five replications consisting of six chicks each. The chicks in group 1 (T_1) were provided with a standard basal diet (broiler starter and finisher) from 0–21 and 22–42 days, respectively. The chicks of the other three groups were also provided with the same basal diet as in T1, along with probiotics at 4.0 (T_2), 6.0 (T3), and 8.0 (T_4) g/kg diet for a period of 42 days. Dietary supplementation of cinnamon, irrespective of levels, had no significant (P>0.05) effect on body weight, feed conversion efficiency, or weight gain over control. It was found that the T_4 group showed numerically better performance compared to the T_1, T_2 and T_3 groups. It was observed that with the increase in the level of cinnamon in the diet, feed intake increased in the broiler chickens. There were 3 deaths, 1 in each treatment supplemented with probiotics (T1, T2, and T4), during the experiment. It was observed that the values for dressing percentage and carcass weight were comparatively higher in T_4 than in other groups. The cost of production was highest in T_4 and lowest in T_1. Also, net profit per unit of weight was highest in T_1 as compared to other probiotic-supplemented groups. On the basis of the findings, it can be concluded that supplementation of probiotics at various levels had not shown any positive impact on performance in terms of body weight gain, feed intake, FCE, and an overall performance index and enhancement with resultant improvement in performance, carcass, and meat qualities.
***Keywords**: feed conversion efficiency, Probiotic, Cinnamon, flora boost-AD_3, sexual behavior, morbidity, and mortality.*

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INTRODUCTION
Poultry is one of the fastest growing segments of the agricultural sector in India with around eight percent growth rate per annum. The poultry sector in India has undergone a paradigm shift in structure and operation which has been its transformation from a mere backyard activity into a major commercial agri based industry over a period of four decades. The constant efforts in up gradation, modification and application of new technologies paved the way for the multifold and multifaceted growth in poultry and allied sectors. The development is not only in size but also in productivity, sophistication and quality. Development of high yielding layer (310- 340 eggs) and broiler (2.4-2.6 kg at 6 wks) varieties together with standardized package of practices on nutrition, housing, management and disease control have contributed to spectacular growth rates in egg (4-6% per annum) and broiler production (8-10% per annum) in India during the last 40 years. The annual per capita availability also increased to 60 eggs and 2.5 Kg of meat, consistently with increase in productivity. However, it is far below the recommended level

of consumption of 180 eggs and 10.8 kg poultry meat per person per annum by Indian Council Medical Research. This transformation has involved sizeable expansions and investments in breeding, hatching, rearing and processing. India is one of the few countries in the world that has put into place a sustained Specific Pathogen Free (SPF) egg production project. The growth of the poultry sector in India is also marked by an increase in the size of the poultry farm. In earlier years broiler farms had produced on average a few hundred birds (200-500 chicks) per cycle. Today units with fewer than 5,000 birds are becoming rare, and units with 5,000 to 50,000 birds per week cycle are common. Similarly, in layer farms, units with a flock size of 10,000 to 50,000 birds have become common. Small units are probably finding themselves at a disadvantage because of high feed and transport costs, expensive vaccines, and veterinary care services and the non-availability of credit. Some small units are reported to be shifting from layer to broiler production because output in broiler units can be realized in six weeks. The structure of India's poultry industry varies from region to region. While independent and relatively small-scale producers account for the bulk of production, integrated large-scale producers account for a growing share of output in some regions. Integrators include large regional farms that incorporate all aspects of production, including the raising of grandparent and parent flocks, contracting production, compounding feed, providing veterinary services, and wholesaling. The southern region account for about 57 percent of the country's egg production, the eastern and central regions of India account for about 17 percent, the northern and western regions contribute 26 percent of egg production.

India ranks 3rd in egg production and 7th in chicken meat production in the world [1]. About 3.4 million metric tonnes (74 billion) of eggs are produced from 260 million layers, and 3.8 million metric tonnes of poultry meat are produced from 3000 million broilers per year in India. The poultry industry is contributing about Rs. 70,000 crores to the national GDP, and the poultry business in India now employs around 1.6 million people, of whom around 80 per cent are directly employed, while the rest (20 per cent) are engaged in its allied areas like feed, pharmaceuticals, equipment, and other services required by the poultry industry[2]. About 2–2.5 million tonnes of poultry litter, a valuable organic fertiliser, are produced as a byproduct every year. The poultry industry is concentrated in certain pockets of the country. The states of Andhra Pradesh, Telangana, and Tamil Nadu lead the country, followed by Maharashtra, Punjab, and West Bengal.

Probiotic is a generic term, and products can contain yeast cells, bacterial cultures, or both that stimulate microorganisms capable of modifying the gastrointestinal environment to favor health status and improve feed efficiency. Mechanisms by which probiotics improve feed conversion efficiency include alteration in intestinal flora, enhancement of growth of nonpathogenic facultative anaerobic and gram positive bacteria forming lactic acid and hydrogen peroxide, suppression of growth of intestinal pathogens, and enhancement of digestion and utilization of nutrients. Therefore, the major outcomes from using probiotics include improvement in growth, reduction in mortality, and improvement in feed conversion efficiency. The manipulation of gut macrobiotic via the administration of probiotics influences the development of the immune response. The exact mechanisms that mediate the immunomodulatory activities of probiotics are not clear. However, it has been shown that probiotics stimulate different subsets of immune system cells to produce cytokines, which in turn play a role in the induction and regulation of the immune response. Probiotics, especially lactobacilli, could modulate the systemic antibody response to antigens in chickens.

Different probiotic activity mechanisms have been proposed, although the majority of them are speculative. Probiotics have a good impact on animals either directly through nutrition or indirectly through a "health effect," where they function as bio-regulators of the intestinal microflora and strengthen the host's natural defense [3]. Probiotic use may have a variety of positive effects, such as altered host metabolism, immune stimulation, anti-inflammatory, exclusion and killing of pathogens in the intestinal tract, decreased bacterial contamination on processed broiler carcasses, improved nutrient absorption and performance, and ultimately reduced risk to human health [4].

The idea of probiotics is no longer as unclear as previously believed. It can currently be used to promote chicken growth instead of antibiotics and chemotherapeutic drugs because it is a significant component of applied biotechnological research. It was once believed by males that all bacteria were hazardous, oblivious to their role in food preparation and preservation, which made the idea of probiotics challenging to grasp. Scientists are currently making an attempt to understand the delicate symbiotic link between chicken and their bacteria, particularly in the digestive tract where they are crucial to both human and poultry health. Probiotics have a huge potential to replace antibiotics because they do not cause the emergence and spread of germ resistance. According to the current review, probiotics can effectively be employed as dietary supplements in poultry feed for a variety of purposes, including growth promotion, modification of intestinal microbiota and pathogen suppression, immunological modulation, and enhancement of meat quality.

MATERIAL AND METHODS

Study Area

The proposed work was carried out at an Instructional farm (poultry Unit) of the Department of Livestock Production and Management, SASRD-Nagaland University, Medziphema campus, Nagaland in India. The study was carried out from May 2022 to June 2022 in India. The farm is located at 93.20 E to 95.15 E longitude and latitude between 25.6 N at an elevation of 310 meters above mean sea level.

The present study was carried out to study the growth pattern, feed intake, feed conversion efficiency, mortality/livability, carcass yield and relative economics on broilers feeding with probiotic (Floraboost AD3) supplemented diet following standard management practices. A total of 120, day old, commercial broiler chicks of hybrid Cobb- 400 strain obtained from a single hatch was procured for the study from M/S Royal Enterprise, Dimapur, Nagaland. Each bird was weighed individually on arrival and randomly assigned to one of the dietary treatment groups. Each treatment had five replications consisting of six birds each on a randomized block design.

The commercial probiotics, Floraboost-AD_3 Powder was used in the experiment contained the following per 100g product:

Sl.No.	Floraboost-AD_3 Powder	Containing
1	Live Yeast Culture	5mg
2	Live *Lactobacillus sporogenes* culture	30 million CFU
3	Amino Acids	2.5 gm
4	Liver Extract	2.5 mg
5	Alpha Amylase	0.5gm
6	Vitamin A	10,00,000 I.U.
7	Vitamin D_3	1,00,000 I.U.

Treatment and Feeding

A total of four (4) groups of thirty (30) chicks each, with five (5) duplicates of six (6) chicks each, were formed from a random division of one hundred twenty (120) chicks into. The day-old chicks were raised for their first 21 days in a deep litter brooder house and for their last 21 days in a finisher housed in cages. The chicks were fed conventional broiler starter between the ages of 0 and 3 weeks, followed by broiler finisher between the ages of 4 and 6 weeks. Group 1 (T1) was the control group and received only the basal diet. The same basic meal as in T1 was also given to the three additional groups of chicks, but probiotic supplements were added. The details of distribution of chicks and their treatment are summarized in table 3.1:

Table 1: Details of distribution of chicks and their treatment.

Group	Basal Diet	Feed additive	Dose	Duration(days)
T_1(Control)	Starter Mash Finisher Mash	None None	None None	0-21 22-42
T_2	Starter Mash Finisher Mash	Probiotic Probiotic	4 g/kg feed 4 g/kg feed	0-21 22-42
T_3	Starter Mash Finisher Mash	Probiotic Probiotic	6 g/kg feed 6 g/kg feed	0-21 22-42
T_4	Starter Mash Finisher Mash	Probiotic Probiotic	8 g/kg feed 8 g/kg feed	0-21 22-42

Table 2: The chemical composition of ration:

Nutrients	Starter Ration	Finisher Ration
Dry Matter (%)	90.20	90.89
Crude Protein (%)	22.37	20.31
Ether Extract (%)	04.47	05.03
Crude Fiber (%)	05.69	05.90
Nitrogen Free Extract (%)	61.25	62.20
Total Ash (%)	06.22	06.56

Body Weight and Growth Rate

The average weight of the chicks' replication-wise was noted when they arrived. After that, the chicks' body weights were measured every week in the early morning hours before being fed. In order to weigh the birds throughout the duration of the experiment, a digital weighing balance with a maximum capacity of 10 kg was employed. The average weight of the chicks was noted in groups during the course of the first three weeks. Each bamboo basket containing 10 chicks was filled with this material beforehand. The birds were weighed individually every week beginning at day 21 until they reached six weeks of age, or day 42.

Feed Intake and Feed Conversion Efficiency

Feed and water were provided ad libitum to all the groups throughout the experimental period. The amount of feed supplied to the birds was recorded daily, and the feed residue, if any, was recorded the next morning. Feed intake was calculated by offering a weighed quantity of feeds according to the treatments with the help of a precise digital weighing balance and expressed in grammes. The leftover feed was subtracted from the total amount of feed supplied the previous day to arrive at the exact quantity of feed consumed by the birds per day. From these data, the average and weekly feed consumption were calculated for each bird in each group and expressed in grammes. The feed conversion efficiency (FCE) of different experimental groups was calculated by adopting the following formula:

$$\text{Feed Conversion Efficiency (FCE)} = \frac{\text{Quantity of feed consumed (g)}}{\text{Total body weight gain (g)}}$$

Mortality/Liveability and Performance Index

Mortality was recorded on daily basis throughout the period of investigation and was expressed in percentage. Mortality was calculated by using the following formula:

$$\text{Mortality (M)} = \frac{\text{Total no. of birds died}}{\text{Total no. of live birds}} \text{x } 100$$

Liveability percentage was calculated by subtracting the mortality percentage from 100.

Performance Index (PI) was calculated by adopting the formula:

$$\text{PI} = \frac{\text{Average body weight (g) X \% Livability}}{\text{Cumulative FCE x No. of days}} \div 100$$

Dressing Percentage, Carcass Yield and Organ Weight

Three birds from each group were randomly chosen at the conclusion of the trial to be used in carcass evaluation tests. Before being killed, the live weight of each individual bird was noted. Kosher Method was used for the slaughter. After all bleeding had stopped and the bird's feathers had been plucked, the dressed weight of the bird was determined. Additionally weighed separately were the heart, liver, spleen, and gizzard (empty), and for each of the four groups, the average weight of each of these organs was noted. The percentage of dressed weight was calculated by using the following formula:

$$\text{Dressing (\%)} = \frac{\text{Dressed weight (g)}}{\text{Live weight (g)}} \times 100$$

Statistical Analysis

The experimental data obtained and calculated were subjected to statistical analysis in order to draw a valid interpretation and see the effects of different treatments on various parameters using ANOVA in a randomized block design as described by Snedecor and Cochran (1998)[5].

RESULTS AND DISCUSSION

Body Weight

The control group (T1) and the various treatment groups (i.e., T2, T3, and T4) had average body weights of 42, 42.03, 40.90, and 41.60 g per bird, respectively. At the end of the sixth week, the equivalent body weight for the various groups was 2318.20, 2258.98, 2204.96, and 2383.66 g per bird, respectively. In comparison to the treatment groups T1, T2, and T3, the table reveals that the treatment group T4 has the highest body weight. Probiotic dietary supplementation during the trial had no discernible impact on broiler body weight. Based on the findings, it was assumed that adding probiotics to the feed of broiler chicken had not resulted in a consistent development pattern. Similar results were in line with earlier research [6, 7].who found no evidence of a body weight difference caused by the addition of probiotics to the broiler diet. On the other hand, probiotic food supplementation was found to significantly increase body weight [8, 9, 10, and 11]. Results may vary because of changes in species or strains, agroclimatic conditions, probiotic concentrations, seasons, etc.

Table.3. Average body weight (gram/bird/week) of broiler birds in different treatment groups.

Treatment	Weeks						
	0th	1st	2nd	3rd	4th	5th	6th
T_1	42.00	112.03	254.83	615.96	1198.50	1890.73	2318.20
T_2	42.03	119.10	260.63	609.33	1183.08	1815.56	2258.98
T_3	40.90	108.10	240.83	540.53	1124.46	1795.34	2204.96
T_4	41.60	122.16	288.40	685.96	1253.86	1985.03	2383.66

Gain in Body Weight

For the T1, T2, T3, and T4 groups, respectively, the overall gain in body weight over the course of the experiment was 2275.97, 2216.94, 2164.08, and 2341.98 g. In the T1, T2, T3, and T4 groups, respectively, the average weight gain was 379.32, 369.49, 360.68, and 390.33 g/bird/week, with T4 seeing the most body weight gain and T1, T2, and T3 experiencing the least. In terms of statistics, there was no discernible difference in weight increase across the treatment groups, regardless of the dosages of probiotic supplementation. As a result of the findings, it was determined that adding probiotics to the food had no impact on body weight gain either during or after the brooding phase. Similar results were reported by [12, 13, 6, and 14]. Who found no appreciable variation in broiler body weight gain as a result of probiotic treatment? However, probiotic treatment was observed to significantly (P0.05) improve the body weight gain in broiler chicks by [15-17]. The variation in the outcome may be explained by variations in the species or strain, probiotic levels, agroclimatic conditions, seasons, etc.

Table.4. Average gain in body weight (gram/bird/week) of broiler birds in different treatment groups.

Treatment	Weeks						Mean
	1st	2nd	3rd	4th	5th	6th	
T_1	70.00	142.80	361.13	582.54	692.23	427.27	379.32
T_2	77.07	141.53	348.70	573.75	632.48	443.42	369.49
T_3	67.20	132.73	299.70	583.93	670.88	409.62	360.68
T_4	80.56	166.24	397.56	567.83	731.17	398.63	390.33

Feed Intake

The total feed intake during the entire trial period for the T1, T2, T3, and T4 groups was 4360.83, 4334.32, 4226.55, and 4448.85g per bird, respectively. Numerically, T4 has the highest feed intake, followed by T1, T2, and T3. However, the statistical analysis revealed no significant difference in feed intake among the treatment groups due to probiotic supplementation. The results were corroborated by the findings of [1, 19, 14], who had also reported non-significant effects of probiotic supplementation on feed intake in broiler birds. However, these findings were contrary to the observations of [20, 21, 22], who had observed a significant difference in feed consumption in broilers fed with a diet supplemented with different levels of probiotics. The variation in result might be due to species or strain differences, different levels of probiotics, agro-climatic differences, seasons, etc.

Table 5: Average feed intake (g/bird/week) of broiler birds in different treatment groups.

Treatment	Weeks						Total
	1st	2nd	3rd	4th	5th	6th	
T_1	125.00	334.67	722.60	794.23	1097.00	1287.33	4360.83
T_2	119.30	388.63	603.53	834.33	1061.29	1327.24	4334.32
T_3	108.80	379.50	585.50	801.71	1078.27	1272.77	4226.55
T_4	121.87	405.97	651.47	840.79	1099.57	1329.18	4448.85

Feed Conversion Efficiency

The average feed conversion efficiency of broiler birds in different groups at the end of the sixth week was recorded as 2.01, 2.02, 2.09, and 1.98 for T1, T2, T3, and T4, respectively. The statistical analysis revealed no significant variation among the treatment groups. This result was in line with the findings of [14, 23], who reported no effect of probiotics on feed conversion efficiency in broiler birds. This variation in result might be due to species or strain differences, different levels of probiotics, agro-climatic differences, seasons, etc.

Table 6. Average feed conversion efficiency of broiler birds in different treatment groups.

Treatment	Weeks						Mean
	1st	2nd	3rd	4th	5th	6th	
T_1	1.78	2.34	2.01	1.36	1.58	3.01	2.01
T_2	1.54	2.75	1.73	1.45	1.68	3.00	2.02
T_3	1.61	2.86	1.96	1.37	1.61	3.11	2.09
T_4	1.51	2.44	1.64	1.48	1.50	3.33	1.98

Mortality/Livability and Performance Index

The mortality percentage of broiler birds from one day old to six weeks of age was zero in Treatment T1 and 3.45 per cent in the T2, T3, and T4 groups. During the time of the experiment, birds were infected with bloody diarrhoea, which could be the reason for mortality. The performance index for T1, T2, T3, and T4 groups was calculated as 269.63, 261.30, 246.53 and 281.63, respectively. The T4 group had the highest performance index (281.63), followed by T1 and T2, and the lowest in T3. In the present study, a better performance index in the T4 group might be due to an adequate level of probiotics as compared to other groups. However, the performance index in the T2 and T3 groups was low, which might be due to the lower level of probiotic supplementation, which had shown a negative trend even in the control group. Similar findings were observed by [24-26], who recorded mortality due to probiotic supplementation. The livability percentage was recorded to be 100 per cent in T1, which might be attributed to favorable climatic conditions, good-quality feed and proper management practices. Whereas, the livability percentage of T2, T3, and T4 was 96.55 per cent.

Dressing percentage, Carcass yield and Organ weight

The average dressing percentage of broiler birds at the end of the sixth week in different groups T1, T2, T3, and T4 was 64.29, 62.82, 71.17, and 72.20 per cent, respectively. The highest dressing percentage was recorded in T4, followed by T3, T1, and the least in the T2 group. The average carcass weight of broiler birds was 1689, 1746, 1842, and 2258 g/bird for the T1, T2, T3, and T4 groups, respectively. Numerically, T4 had the highest carcass weight, followed by T3, T2, and the least in the T4 group. The average gizzard weight was 42.58, 42.16, 44.50, and 42.27g for the T1, T2, T3, and T4 groups, respectively. Numerically, the highest gizzard weight was obtained in T3 as compared to other treatments. The average heart weight for the T1, T2, T3, and T4 groups was 12.55, 12.22, 12.48, and 12.69 g, respectively. The heart weight was more or less similar across all treatments. Likewise, the average live weight was 59.47, 56.99, 57.51, and 63.45 g for T1, T2, T3, and T4, respectively. There was a remarkably higher weight recorded in T4 compared to other treatments. The average spleen weight was 6.20, 4.61, 4.50, and 3.88 g for the T1, T2, T3, and T4 groups, respectively. The highest spleen weight was recorded in T1 and the least in T4.

Table 7: Average dressing percentage, carcass yield and organs weight (gm/bird) of broiler birds in different treatment groups.

Group	Dressing %	Carcass Weight (g)	Organ Weight (g)			
			Gizzard	Heart	Liver	Spleen
T_1	64.29	1689	42.58	12.55	59.47	6.20
T_2	62.82	1746	42.16	12.23	56.99	4.61
T_3	71.17	1842	44.50	12.48	57.51	4.50
T_4	72.20	2258	42.27	12.69	63.45	3.88

From the results, it was observed that the values for dressing percentage and carcass yield were numerically the best in the T4 group as compared to the other groups. However, the values for the organ's weight were more or less similar, irrespective of the level of probiotics supplemented in the diet. Higher dressing percentage and carcass yield in T4 might be due to the positive influence of probiotics on nutrient utilization that led to more gain in body weight of the broilers. Also, it was noted that the live weight of birds in T4 was much higher when compared to other treatment groups. Similar findings had also been reported by [27, 28, 29], who observed higher dressing percentage and carcass yield when probiotics were supplemented in the diet of broilers.

CONCLUSION

The live weight and gain in body weight were similar among the treatments, irrespective of whether the birds were supplemented with probiotics or not. The feed intake and feed conversion efficiency were more or less similar in all the treatments. The control group had the best survival rate. The performance index was better in the T4 group as compared to other levels of supplementation or without supplementation. The highest dressing percentage was found in the T4 group as compared to other levels of supplementation or without supplementation. The net profit was highest in T1 as compared to other supplemented groups. Among the probiotic supplement groups, the net profit was the highest in the T2 group. Finally, from the present results it may be concluded that supplementation of probiotics at various levels did not show superiority over the control group in terms of body weight, feed intake and FCE, overall performance index, carcass characteristic as well as profit per bird. However, in the "No chemical Era" supplementation of probiotics @ 4.0 g/kg feed can be advocated as an alternative to antibiotic supplementation.

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