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Effect of Phytogenic Growth Promoter on Broiler Birds

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The present experiment was conducted to study the biological effect of phytogenic growth promoter supplemented with the diet or added in the drinking water in the broiler birds. In the experiment, two proven phytogenic growth promoters, Digestarom 1317 (dosage 150 ppm) and Digestarom 1440 (dosage 800 ppm) AC were fed to the broiler chickens against an antibiotic growth promoter, Bacitracin Methylene Disalicylate (BMD). The experimental birds were distributed into four equal groups viz., T1, T2, T3 and T4. Birds of the negative control group (T1) were supplemented with basal diet but no growth promoter and birds of the positive control group (T2) were supplemented with basal diet with BMD. Birds of T3 and T4 groups were supplemented basal diet along with two different doses of phytogenic feed additive, Digestarom 1317 @ 150 ppm and Digestarom 1440 @ 800 ppm. Studies on different biological parameters revealed that phytogenic growth promoters significantly ($P<0.001$) enhance the productive performance of treatment group

Keyword: Biological Parameters, BMD, Phytogenic Growth Promoter.

1. Introduction

Phytogenic feed additives (often also called phytobiotics or botanicals) are commonly defined as plant-derived compounds incorporated into diets to improve the productivity of livestock through amelioration of feed properties, promotion of the animals' production performance, and improving the quality of food derived from those animals, such as herbs (flowering, non woody, and non-persistent plants), spices (herbs with an intensive smell or taste commonly added to human food), essential oils (volatile lipophilic compounds derived by cold expression or by steam or alcohol distillation), or oleoresins (extracts derived by non-aqueous solvents). Within phytogenic feed additives, the content of active substances in products may vary widely, depending on the plant part used (e.g. seeds, leaf, root or bark), harvesting season, and geographical origin. The technique for processing (e.g. cold expression, steam distillation, extraction with non-aqueous

solvents etc.) modifies the active substances and associated compounds within the final product.

The present investigation was conducted on broiler birds to study the biological studies of growth performance, to assess bacteriological load in different parts of digestive tract and to study the morphological studies of gut and villus height in different segments of small intestine mainly in duodenum.

Table 1: Grouping Pattern of Experimental Chick.

S. No.	Treatment	Code	Number of birds
1	Negative control	T1	48
2	Positive control	T2	48
3	Digestarom 1317	T3	48
4	Digestarom 1440	T4	48

2. Materials and Methods

In the present study the experiment was conducted for evaluating the efficiency or effect of the phytogenic growth promoter. The phytogenic growth promoter was active throughout the gastrointestinal tract and as a consequence, it will exert broad spectrum antimicrobial action, will enhance nutrient utilization by improving gastrointestinal histo-morphology and will augment the host immunity. In the experiment, two proven and approved phytogenic growth promoters, Digestarom 1317 (dosage 150 ppm) and Digestarom 1440 (dosage 800 ppm) AC were fed to the broiler chickens against an antibiotic growth promoter, Bacitracin Methylene Disalicylate (BMD).

Table 2: Effect of phytogenic growth promoter on body weight per week basis (gm).

T1	T2	T3	T4	Polled SEm	P value
52.57	53.78	51.95	53.79	0.34	0.48
126.90	127.75	126.10	129.50	0.85	0.62
318.35	340.20	321.24	339.50	1.26	0.31
587.66^{a}	649.85^{b}	635.92^{b}	650.50^{b}	3.87	0.043*
915.80^{a}	1120.82^{b}	1047.82^{b}	1152.7^{c}	8.65	0.007**
1253.52^{a}	1511.50^{b}	1449.02^{b}	1534.50^{c}	8.94	0.003**
1457.75^{a}	1916.7^{b}	1886.52^{b}	1976.25^{c}	8.97	0.006**

*P<0.005, **P<0.001 Values bearing different superscripts within a row differ significantly

Digestarom AC is a combination of phytogenic components with glycerides of short chain fatty acids. Basically, Digestarom AC is a complex of plant extracts and plant essential oils along with monoglycerides, lactic acids and multiglyceride complexes. Being a complex of plant extracts and essential oils, Digestarom AC is hypothesized to stimulate feed intake, intestinal secretion of enzymes and enhance digestibility of nutrients. Additionally, Digestarom AC is anticipated to act as a broad spectrum antimicrobial substances throughout the gastrointestinal tract and promote development of the villus structure of the gut.

a. Experimental broiler birds and their management

The experiment was conducted in the Poultry shed at Faculty of Veterinary & Animal Sciences, West Bengal University of Animal and Fishery Sciences, Kolkata, India. Few days prior to the arrival of the chicks, the experimental house and cages were fumigated with potassium permanganate ($KMnO_4$) and formaldehyde solution (40 ml formaldehyde + 20 gm $KMnO_4$ per 100 cu.ft). Before fumigation all the ventilators, windows and doors were closed and sealed. The house was kept dry, clean, disinfected, protected and well ventilated throughout the experimental period.

Table 3: Effect of phytogenic growth promoter on body weight gain per week basis (gm.)

T1	T2	T3	T4	Polled SEm	P value
74.33	73.97	74.15	75.71	0.87	0.25
191.45	212.45	195.14	210	2.67	0.73
269.31	309.65	314.68	311	4.76	0.38
328.14^{a}	470.97^{b}	411.9^{b}	502.20^{b}	10.43	0.002***
337.72^{a}	390.68^{b}	401.20^{b}	368.75^{b}	6.78	0.035*
204.23^{a}	405.20^{b}	437.5^{b}	441.75^{b}	12.89	0.007**

***P<0.001, Values bearing different superscripts within a row differ significantly

One hundred and ninety two day-old broiler chicks of Vencobb-400 strain were procured from a commercial hatchery. Water with glucose and electrolytes were administered to the chicks on their arrival which was followed by weighing of the individual chicks and their random distribution into the respective groups (treatment and control).Each groups comprised 4 replicate of 12 birds each. The chicks were maintained under standard conditions of hygiene and management. The birds were vaccinated against Newcastle Disease (La Sota) on 7^{th} and 28^{th} day and against infectious bursal disease orally on 14^{th} day of experiment through drinking water.

The experimental birds were distributed in four groups as maintained in Table I. Each group offered basal diet as mentioned in Table 2. T1 group offered only basal diet without any growth promoter .T2 group offered basal diet with B.M.D. (Bacitracin Methylene Disalicylate) @ 500mg/kg body weight; whereas T3 and T4 group offered basal diet with two different dosages of phytogenic growth promoter @150 ppm and @ 800 ppm respectively.

Table 4: Microbial population in the crop.

Attributes	*E.coli*	*Salmonella*	*Lactobacillus*
T1	35	29	183^{b}
T2	N.D.	N.D.	63.8^{c}
T3	N.D.	N.D.	709.2^{a}
T4	N.D.	N.D.	714.5^{a}
Polled SEm	-	-	89.07

Figures in parenthesis indicate the count of bacteria expressed as log $_{10}$CFU/g of content. ND: Not detectable, (P<0.001)

b. Studies on growth performance

Body weight of individual bird of each group was recorded at the commencement of the experiment (day 0) and subsequently at weekly interval in the morning before offering feed water to the birds till the termination of the experiment at 6 weeks of age. Then the body weight gain was calculated.

c. Bacteriological studies of gastrointestinal tract content

The entire gastrointestinal tract along with crop, proventriculus, gizzard, part of small intestine was severed from two birds of a replicate in each treatment group and was separated. The content present inside these segment were gently expelled into sterile Petri dishes and 1g of content from each segment was taken in sterile test tubes and diluted to 10 ml with triple distilled deionized water (autoclaved at 15 lbs pressure for 15 min).The contents were then serially diluted and the final dilution of 10^5 was used for enumeration of *Escherichia coli*, *Salmonella sp*. and *Lactobacillus sp*. 0.1 ml from the diluted contents was spread with a sterile platinum loop on the surface of specific culture media and incubated aerobically at 37°C for 24 to 48 h and the colonies were enumerated. The bacterial counts were expressed as $\log_{10}$ CFU (colony forming units) per gram of content.

Table 5: Effect of phytogenic growth promoter on villus height in different parts of small intestine.

T1	T2	T3	T4	Polled SEm	P value
904.70^{a}	1118.46^{b}	1182.54^{c}	1238.45^{c}	8.29	0.037*

Values bearing different superscripts within a row differ significantly, (*P<0.001)

d. Morphological studies of gut and measurement of villus height

Slides were prepared by sectioning and staining of tissues from different segment of small intestine of sacrificed birds of each group. Height of intestinal villus was measured by ocular micrometer under 10X objective of the compound microscope. Average of six readings was taken. The reading obtained from ocular micrometer was multiplied by conversion factor, (calculated with the help of stage micrometer) to obtain the actual height in millimeter (mm). Then the length was converted into micron (μ).

e. Statistical analysis

All data were analyzed in the general linear model (GLM) of SPSS version 10.0 (1999). Dietary combinations were used as the fixed factors and the results were expressed as mean and pool standard error mean. Probability value of $p<0.05$ was described as statistically significant and $P<0.01$ was described as highly significant.

3. Results

a. Biological studies of growth performance

The effect of phytogenic growth promoter on body weight and body weight gain (per week basis) is presented in Tables 2 and 3 respectively. From the Table 2 it is evident that after the end of 2nd week of experiment, there was no significant difference in body weight of the birds of the control (T1 and T2) and two treatment groups. (T3 andT4).

At the end of 3rd week there was significant difference between the negative control (T1) and the rest groups ($p<0.05$).The highest body weight was observed in the birds of T4 group followed by T2, T3 and T1 groups respectively. Birds of the negative control group revealed the lowest body weight.

From the Table 3 it was obvious that after the end of 3rd week of experiment, there was no significant difference in body weight gain of the birds of the control(T1 and T2) and two

treatment groups.(T3 and T4) (P>0.05). At the end of 4th week of the experiment significant difference in body weight gain among the birds of the T1 and rest of the groups ((T2, T3 and T4) were noticed (P<0.001) though there was subtle difference among the birds of T2, T3 and T4 treatment groups. Birds of T4 group revealed highest body weight gain followed byT2, T3 and T1 groups respectively. Birds of the negative control group revealed lowest body weight gain. At the end of 5th week there was significant difference (P<0.05) in body weight gain among the birds of T1 and rest of groups. Birds of T3 group exhibited highest body weight gain and birds of negative control group revealed lowest body weight gain. Supplementation of phytogenic growth promoter results in much more body weight gain than that of BMD group.

b. Bacteriological studies

Pathogenic bacteria like *Escherichia coli* and *Salmonella sp* were not detected in the crop content of birds of T2, T3, and T4 group. T1 group showed highest population of the previously mentioned pathogenic bacteria. *Lactobacillus sp* was present in the crop of birds of all groups (Table 4).

c. Effect on villus height

Villus height of different parts of small intestine of the experimental broiler birds of control and treatment group is presented in Table 5. Average villus height of small intestine of group T1, T2, T3 and T4 were 904.70, 1118.46, 1182.54 and 1238.45 micron (µ) respectively. Statistical analysis revealed significantly (P<0.001) higher villus height in the birds of treatment group (T3 and T4 group) in comparison to that of T2 group. No significant difference in villus height was detected among birds of T3 andT4 group. Highest villus height was detected in the small intestine of the birds of T4 group. The villus height of T2 group is lower than that of T3 and T4 group.

4. Discussion

The results of present study are in accordance with the findings of Jamroz and Kamel (2002) who observed improvements in daily weight gain (8.1%) and in feed conversion ratio (7.7%) of chickens when feed with diets supplemented (300mg/kg) with a plant extract containing capsaicin, cinnamaldehyde and carvacrol. The present investigation also reveals similar results. Biavatti *et al*. (2003) reported *Alternanthera brasiliana* extracts (180 ml/200 kg feed) improved broiler performance from 14 to 21 days. The findings of the present investigation corroborates with that of the previous worker. Hernandez *et al*. (2004) studied that blend of essential oils of cinnamon, pepper and oregano compounds improved digestibility of nutrients in chicken. Jang *et al*. (2006) in chicken is the benefit of some natural substances on gastro intestinal enzymatic activity, most likely improving nutrient digestibility.

Burt (2004) stated microbial analysis of minimum inhibitory concentration (MIC) of plant extracts from spices and herbs, as well as of pare active substances, revealed levels that considerably exceeded the dietary doses when used as phytogenic feed additive. Aksit *et al.* (2006) reported antimicrobial action of phytogenic feed additive may be in be improving the microbial hygiene of carcass. The present study is in accordance with the earlier findings.

Batal and Parsons (2002) indicated that micronutrients also influenced the morphology of intestines. They observed an increased height of villi of jejunum in broilers at 28th day of age when fed with 5g BioMos/Kg from 7 to 28 day. Jamroz *et al.* (2006) have conducted a study that phytogenic formulations contained pungent principles (e.g. capsaicin) significantly increased intestinal mucus production.

5. Conclusion

From the findings obtained from the present investigation it can be concluded that phytogenic growth promoter enhance productive performance of the broiler in terms of body weight gain with minimum alteration of gut morphology and the possibility of bacterial invasion is much less. Phytogenic growth promoter can be used as a potent replacer of antibiotic growth promoter if used at optimum level.

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