

Comparative Effect of Polyherbal Agents and Organic Acid to Substitute Antibiotic Growth Promoters in Broilers for Combating Drug Resistance

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Abstract An experiment was conducted on one hundred sixty day old commercial broiler chicks (Cobb-strain) to study the comparative effect of polyherbal agents and organic acids as substitute for antibiotic growth promoters. The birds were randomly divided into four groups (40 birds/group), housed group wise in electrically heated brooder cages (0—3 wk) and transferred to battery cages (4—6 wk). The experimental diets were no feed additive (T_0), polyherbs

(T_1), organic acid (T_2) and antibiotics (T_3). These groups were evaluated for feed consumption, feed conversion ratio (FCR) and nutrient digestibility. Results revealed that feed intake was significantly higher in T_0 group as compared to other treatment groups with lowest in T_1 whereas body weight was found to be significantly higher in T_1 followed by T_2 and T_3 in comparison to T_0 . FCR was found to be narrow in the T_1 treatment group followed by T_2 , T_3 and T_0 . The digestibility of different nutrients as well as the retention of nitrogen, calcium and phosphorus was comparable in all treatment groups. It is concluded that the supplementation of polyherbal agent and organic acid resulted in better FCR, can serve as a substitute to antibiotic growth promoters and preventing spread of antibiotic resistant microbes in humans or environment.

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Introduction

Ever increasing feed costs and consumer concerns about chemical feed additives forced poultry farmers to look for newer and safer feed additives, which could improve feed utilization/efficiency, product quality and concurrently should not leave chemical residue in the product. Antibiotics are routinely used at sub therapeutic dosage (as feed additive) to improve the performance of birds [1] but now-a-days there is great

Table 1. Chemical composition of broiler starter and finisher mash (% DM).

Nutrients	Broiler starter	Broiler finisher
Crude protein	22.05	19.05
Crude fiber	5.44	5.86
Ether extract	5.75	5.89
Nitrogen free extract	61.04	62.14
Total ash	6.34	6.23
Calcium	1.33	1.45
Phosphorus	0.73	0.68
Metabolizable energy (kcal/kg)	2913	2999

concern regarding the use of antibiotics in feed due to emergence of multi drug resistant bacteria and antibiotic residue effect [2]. Alternative to antibiotics, a range of organic feed additives of microbial or plant origin have been tested for their effect on the performance of broilers [3]. Also, various herbs that are commonly known for their beneficial effects in human food, has also been evaluated as additives in poultry feed [4]. Previous studies revealed that herbal preparations and organic acids based feed additives have made a tremendous contribution to the profitability in the intensive husbandry by stimulating growth, improving gut efficiency and immunomodulatory effects, which results in lower mortality, morbidity and overall better performance in poultry [5–8]. But there is scanty information available on the comparative studies of herbal, antibiotic and organic acids. Therefore, the present study was envisaged to investigate the comparative effect of polyherbal agents, organic acid and antibiotics on the performance of broilers.

Materials and Methods

One hundred sixty commercial, unsexed, day old broiler chicks (Cobb-strain) belonging to same hatch were purchased from Simrun commercial hatchery, Indore and were allotted randomly into four groups

Table 2. Mean weekly feed consumption (g) of experimental broilers of different treatments. *Values bearing different superscript in a row differ significantly ** ($p<0.01$); * ($p<0.05$), NS-non significant, T₀: no additive; T₁: polyherbal feed additive, T₂: organic acid; T₃: antibiotic.

Week	T ₀	T ₁	T ₂	T ₃	Significance
1	129.75± 5.85	119.00± 4.64	119.50± 7.64	124.51± 6.91	NS
2	305.75± 11.25	275.75± 18.08	287.11± 12.12	294.21± 10.08	NS
3	485.25± 21.10	433.50± 30.65	435.29± 26.70	459.10± 19.81	NS
4	613.11± 19.08	595.75± 20.48	597.10± 20.70	605.08± 17.70	NS
5	805.50 ^a ± 21.32	696.00 ^c ± 21.08	731.11 ^{bc} ± 23.85	768.25 ^{ab} ± 30.63	*
6	965.20 ^a ± 21.29	827.50 ^c ± 20.64	892.25 ^{bc} ± 21.65	926.75 ^b ± 21.49	**

(40 birds/group) with ten replicates in each group. Chicks were housed group wise in electrically heated brooder cages (0–3 wk) and transferred to battery cages (4–6 wk). Feed was procured from the local market for the feeding of broilers (starter and finisher mash feed) and was used to prepare four diets for treatment groups T₀, T₁, T₂ and T₃ by adding 0% ad-

Table 3. Mean weekly live body weight (g) of experimental broilers of different treatments. *Values bearing different superscript in a row differ significantly ** ($p<0.01$); * ($p<0.05$), NS-non significant, T₀: no additive; T₁: polyherbal feed additive, T₂: organic acid; T₃: antibiotic fed group.

Week	T ₀	T ₁	T ₂	T ₃	Significance
day					
old	52.20± 1.64	52.12± 2.48	52.35± 1.44	51.25± 1.84	NS
1	131.50± 2.64	135.50± 3.04	136.75± 3.85	135.50± 2.67	NS
2	313.25± 5.54	322.5± 4.44	318.75± 6.79	320.75± 5.47	NS
3	548.12 ^b ± 9.22	587.50 ^a ± 15.27	571.14 ^a ± 12.01	554.25 ^b ± 9.54	*
4	859.75 ^{bc} ± 11.54	942.51 ^a ± 13.27	901.57 ^b ± 23.66	868.31 ^{bc} ± 19.31	*
5	1273.11 ^c ± 22.51	1395.75 ^a ± 23.94	1335.75 ^b ± 19.65	1289.51 ^c ± 18.90	*
6	1763.25 ^c ± 25.93	1913.11 ^a ± 24.63	1843.75 ^b ± 21.65	1784.15 ^c ± 22.25	**

Table 4. Mean weekly feed conversion ratio of experimental broilers. *Values bearing different superscript in a row differ significantly *($p < 0.05$), NS-non significant, T₀: no additive; T₁: polyherbal feed additive; T₂: organic acid; T₃: antibiotic fed group.

Weeks	Groups				
	T ₀ (control)	T ₁	T ₂	T ₃	
1	1.61±0.06	1.43±0.08	1.44±0.06	1.47±0.04	NS
2	1.62±0.08	1.47±0.10	1.57±0.08	1.57±0.08	NS
3	1.97 ^a ±0.09	1.63 ^b ±0.11	1.71 ^b ±0.09	1.94 ^a ±0.09	*
4	1.96 ^a ±0.12	1.66 ^b ±0.13	1.70 ^b ±0.11	1.93 ^a ±0.11	*
5	1.94 ^a ±0.14	1.53 ^b ±0.15	1.68 ^{ab} ±0.14	1.84 ^a ±0.13	*
6	1.95 ^a ±0.15	1.55 ^b ±0.13	1.75 ^a ±0.16	1.86 ^a ±0.14	*

ditive, polyherbal feed additive @ 250 g/ton of diet (*Trachyspermum ammi*-100g, *Curcuma longa*-100g, *Rheum emodi*-80 g with inert carrier qs/kg), organic acid @ 1 kg/ton of diet (acetic acid-51g, formic acid-80 g, citric acid-25 g with inert carrier qs/kg) and antibiotic @ 500 g/ton of diet (colistin sulfate 0.1%, doxycycline 1%), respectively. The chemical composition of starter and finisher feed is given in Table 1. Feed intake of each treatment group was recorded on daily basis and body weight of birds was recorded at weekly intervals. A metabolism trial (4 days) was conducted at 4th week of age to study nutrient utilization. The feed and faecal samples were analyzed for proximate principles, calcium and phosphorus [9]. Data generated was analyzed by generalized linear model analysis of variance procedure [10] and the means having significant difference were ranked as per Duncan's multiple range test [11].

Results and Discussion

The average weekly feed consumption (g) for different treatment groups is presented in Table 2. The results revealed that feed consumption showed no significant difference ($p > 0.05$) in the first four weeks, while for 5th and 6th week it varied significantly. However in both the weeks, feed intake was higher in T₀ (805.50; 965.20) and lowest in T₁ (696.00; 827.50), whereas T₂ (731.11; 892.25) and T₃ (768.25; 926.75) lies in range between them. Previous authors also reported lower feed intake on supplementing polyherbal feed additive [12, 13]. Also organic acid supplemented group has lower feed intake than T₀ group which is in agreement with earlier researches [14—16]. Whereas Sarkar et al. [17] observed non significant ($p < 0.05$) differences in feed intake in broilers supplemented with probiotics (yeast culture) and antibiotics (auryomycin) singly or in combination in broiler ration.

The weekly body weight gain (g) was significantly higher in T₁ than other treatment groups from 3rd week onwards (Table 3). It is in agreement with earlier researches [18—20]. Also it was found that T₂ group had significantly ($p < 0.05$) higher body weight in comparison to T₀ and T₃ group which is in agreement with [16, 21]. Also, weekly mean feed conservation ratios is narrower ($p < 0.05$) in T₁ in comparison to T₀ and T₄ whereas the values were comparable for T₁ and T₂ (Table 4). Similar results were found in different studies by Bhushan et al. [22]. Zang et al. [21] and Mahmood et al. [23].

The digestibility of dry matter and other nutrients as well as retention of N, Ca and P were comparable in all treatment groups. Samata and Biswas [24] also reported that addition of *Streptococcus* culture

Table 5. Nutrient utilization of different experimental groups.

Group	DM	CP	Nutrient digestibility (%)			Nutrient retention (%)		
			EE	CF	NFE	N	Ca	P
T ₀	58.35±0.04	53.75±0.40	67.76±0.40	31.10±0.1	71.85±0.96	55.34±2.14	52.85±1.35	51.45±1.30
T ₁	62.85±0.06	57.02±0.04	69.33±0.04	32.89±2.1	73.54±1.41	57.88±1.40	55.01±1.03	53.35±0.12
T ₂	61.98±0.09	56.04±0.81	68.89±0.41	32.65±0.8	73.44±2.11	57.67±1.11	54.87±2.01	53.12±3.21
T ₃	60.75±0.08	55.43±0.31	68.57±0.57	32.35±1.4	72.65±1.42	56.82±1.62	53.64±1.25	52.76±1.20

in broiler diets did not cause any difference in the retention of N, Ca, and P. Gupta et al. [25] also reported non significant difference in DM, CP, EE and NFE digestibility and retention of Ca, and P between the treated groups. Likewise Grover et al. [26] also observed no difference in nutrient utilization on supplementing different levels of Jiwanti.

These results inferred that polyherbal agents used @ 250 g/ton of diet was found to be significant to improve the overall performance regarding better body weight gain, better FCR in comparison to organic acid and antibiotic feed additives. It was also concluded that Organic acid can be use as a growth promoter instead of antibiotic which also showed overall better performance. Thus emergence of multi drug resistant bacteria and residual effect of antibiotic on consumers can be prevented by using polyherbal agents and organic acid as growth promoters in broilers.

Conclusion

Thus from the overall results it may be conclude that poly herbal agents are the best substituent for antibiotics in feed followed by organic acids to combat drug resistance.

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