RESEARCH ARTICLE

Effect of Phytobiotic Mixture and Organic Acid Supplementation on Growth Performance, Haemato-biochemical Profile and Carcass Traits of Broiler Chickens

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Abstract

This study was undertaken to assess the effect of phytobiotic mixture and organic acid on the performance of broiler chickens. Day-old broiler chicks (n=250) were randomly divided into five groups with five replicates of 50 chicks and fed a basal diet with no supplement in the negative control (NC), supplemented with antibiotic (PC), alcoholic extract of 1.0% phytobiotic mixture (HE), 0.1% butyric acid (OA) and 1.0% phytobiotic mixture (alcoholic extract) + 0.1% butyric acid (HEOA). The impact of these supplements on body weight gain (BWG), feed intake (FI), feed conversion ratio (FCR), haemato-biochemical parameters, carcass characteristics, and economics were assessed in 42 days of experiment. The results revealed that BWG of birds were significantly ($p < 0.05$) higher in HEOA, HE and PC group compared with NC. FI and FCR of HE, OA, and HEOA groups were significantly ($p < 0.05$) lower than NC and PC group showed the lowest FCR. Phytobiotic mixture and OA both alone and in combination showed significantly ($p < 0.05$) higher serum glucose and globulin level than NC with no difference to PC group. HE and HEOA groups had a significantly ($p < 0.05$) higher A:G ratio than other groups. The serum cholesterol was lower ($p < 0.05$) in HE, OA, and HEOA groups than PC group birds. No significant effect of phytobiotic and organic acid was observed on the drawn yield of broilers. It was concluded that supplementation of alcoholic extract of 1% phytobiotic mixture with 0.1% butyric acid improved the performance of birds without any detrimental effect on their health.

Keywords: Broilers, Carcass, Haemato-biochemical, Organic acid, Performance, Phytobiotics.

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Introduction

At present broiler industry is one of the biggest growing sectors of agriculture with a growth rate of 7-8% in India (DAHDF, 2018). The growth in the broiler segment is expected to remain strong due to consumer preference for cheap sources of protein, increasing income levels, and changing food habits. Antibiotic growth promoters (AGPs) have been used to increase the growth of broilers and the production of quality meat at a low cost. However, the use of AGPs leads to the emergence of antibiotic resistance in bacteria and the accumulation of their residues in animal products (Dhama *et al.,* 2015). Therefore, it is necessary to search for alternatives of AGPs that can improve the growth and feed efficiency of birds. In this regard, interest has been increased in scientific community to use AGP alternatives like phytobiotics and organic acids as feed supplements in poultry production.

Phytobiotics are plant-derived products and are generally recognized as safe due to its naturally less toxic and residue-free nature. Phytobiotic supplements improve the growth performance, nutrient utilization, and livability of birds. Phytobiotics comprised a wide range of plants like herbs, spices, and plant-derived essential oils; therefore, the study has been planned to use indigenous medicinal plants like aloe vera, ashwagandha, black cumin/mangrail, turmeric, fenugreek, neem, punarnava, basil/tulsi, bhumi amla and garlic in combination to make a novel phytobiotic supplement. Organic acid also improves birds' performance and nutrient utilization by decreasing pH and viscosity of gut, antimicrobial action against gut pathogenic microorganisms, and preservation of feed from microbial penetration (Ndelekwute *et al*., 2018). Thus, considering the limitations of antibiotic growth promoters in broilers and the benefits of phytobiotics and OA, the present experiment was carried out to assess the potential of phytobiotic mixture OA and their combinations on growth performance, haemato-

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biochemical parameters and carcass characteristics of broiler chickens.

Materials and Methods

For the present experiment, approval from the "Institutional animal ethical committee (IAEC)" was obtained vide reference number IAEC/CVSc/2019/09. A total of 250 day old Vencobb-400Y broiler chicks were randomized divided into five dietary treatments with 5 replicates of 10 chicks in each. The chicks were placed into five dietary treatments i.e. either a basal diet with no supplement in the negative control (NC) or that supplemented with antibiotic (Positive control, PC), alcoholic extract of 1.0% phytobiotic mixture (HE), 0.1% butyric acid (OA) and 1.0% phytobiotic mixture (alcoholic extract) + 0.1% butyric acid (HEOA) groups. The phytobiotic mixture containing a blend of turmeric rhizome, black cumin seed, fenugreek seed, neem leaf, tulsi leaf, aloe vera leaves, garlic bulb, punarnava root, ashwagandha root and bhumi amla root was premixed in a certain proportion and alcoholic extract of the polyherbal mixture was prepared in Soxhlet and dried . The dried extract powder was added @ 1 % to the lot of feed. Birds were fed *ad libitum* in pre-starter (1-7 days), starter (8-21 days), and finisher (22-42 days) phases. The basal diets were formulated as per BIS (2007) standards.

The chicks were provided fresh and clean drinking water in deep litter system under uniform standard management conditions. Individual body weight (BW) at the zero-day and weekly interval was recorded up to 42 days. Replicate-wise feed intake (FI) of chicks was recorded at weekly intervals, and from these data, body weight gain (BWG) and feed conversion ratio (FCR) were calculated accordingly. At the end of the experiment, the economic return was also estimated to determine the commercial viability of phytobiotic mixture and organic acid supplementation in broiler production. Blood samples were collected aseptically from the wing vein at the end of the experiment to assess the hemato-biochemical parameters. The hemoglobin (Hb), packed cell volume (PCV), total leucocyte count (TLC), heterophils and lymphocytes were determined by adopting standard procedures. Glucose, total protein, albumin, globulin, and total cholesterol were estimated from the serum samples using auto-span commercial diagnostic kits (Arkrey Healthcare Private Limited, Surat, India). At the end of the experiment, three birds from each replicate were slaughtered. Different carcass parameters like dressed weight, eviscerated weight, drawn yield, heart weight, liver weight, gizzard weight, abdominal fat, thigh and thigh drumstick weight were determined.

The data were analyzed under a completely randomized design (CRD) by employing one way analysis of variance (Snedecor and Cochran, 1994), and means of different dietary treatments were compared with Duncan Multiple range test. The p-value less than 0.05 was considered significant.

Results and Discussion

Growth Performance

The data pertaining to the growth performance of birds in terms of BWG, FI, FCR, EBI and EPEF and economic return presented are Table 1. The body weight gain (BWG) of HEOA and HE group birds were significantly ($p < 0.05$) higher than NC but lower than PC group birds. However, HEOA group birds showed the highest gain among non-antibiotic supplemented group birds. Feed intake was lowest in HE group, followed by OA and HEOA group birds. HEOA, HE, and OA group birds showed significantly ($p < 0.05$) lower FCR than NC but higher than PC group birds. Among non-antibiotic groups, HEOA group birds' FCR was lowest, followed by HE and OA group birds. The European broiler index (EBI) and European production efficiency factor (EPEF) of HEOA, OA, and HE groups were significantly ($p < 0.05$)

Table 1: Performance of broilers fed alcoholic extract of phytobiotic mixture and organic acid

Attributes	*NC*	*PC*	*HE*	*OA*	*HEOA*	*SEM*	*p-value*
Initial BW(g)	50.20	51.00	51.00	49.80	50.80	0.183	0.133
Final BW (g)	2209.00^{d}	2907.20^{a}	2335.80^{bc}	2250.80^{cd}	2439.40^{b}	53.80	<0.001
BW gain/broiler (g)	2158.80^{d}	2856.20^{a}	2284.80^{bc}	2201.00^{cd}	2388.60^{b}	53.74	<0.001
Feed intake/broiler (g)	5419.60^{a}	5249.80^{b}	4888.60^{d}	4936.20^{cd}	5071.60^{c}	45.67	<0.001
FCR	2.51^{d}	1.84^{a}	2.14^{b}	2.24^{c}	2.12^{b}	0.03	<0.01
EBI*	196.44^{d}	370.11^{a}	250.19^{bc}	233.82^{c}	272.09^{b}	12.88	<0.001
EPEF**	201.00^{d}	376.71^{a}	250.42^{bc}	239.11^{c}	273.64^{b}	12.56	<0.001
Total cost/broiler (₹)	201.37^{a}	199.82^{a}	194.25^{b}	190.18^{b}	201.52^{a}	1.088	<0.001
Sale price/broiler (₹)	207.94^{c}	273.66^{a}	214.89^{bc}	216.07^{bc}	234.17^{b}	11.56	<0.01
Profit /broiler (₹)	6.57^{c}	73.84^{a}	20.64^{bc}	25.89^{b}	32.65^{b}	5.033	<0.001
Profitability (%)	103.22^{b}	136.97^{a}	110.62^{b}	113.61^{b}	116.20^{b}	2.514	<0.001

Means with different superscripts in a row between groups differ significantly ($P < 0.05$).
*European broiler index;** European production efficiency factor; (₹) Indian Rupee

higher than NC group broilers. The economic data revealed that the cost per broiler was significantly ($p < 0.05$) lower in HE and OA groups as compare to HEOA, PC and NC groups. Profit per bird was significantly ($p < 0.05$) higher in HEOA, OA, and HE group than NC, but lower ($p < 0.05$) to PC group.

The present findings of better BWG in HEOA group broilers are similar to the findings of Jahejo *et al.* (2019), who found significantly ($p < 0.05$) better BWG with dietary supplementation of 5 g basil/kg of feed. Similarly, Khan *et al.* (2018) also found that supplementation of 2% polyherbal mixture in broilers diet improved their growth performance. The results of lower FCR in HEOA group were in harmony to the findings of Urusan and Bolukbas (2017), who found significantly ($p < 0.05$) better FCR in broilers supplemented with 2 g/kg turmeric powder in their diet. Kackmarek *et al*. (2016) also observed higher feed efficiency with the supplementation of fumaric acid. Similarly, better economic performance was observed with the supplementation of phytobiotics and/or organic acids as compared to control broilers (Rawat *et al.*, 2016). The improvement in performance indices of the broilers might be due to synergistic action of the active principles of phytobiotic mixture and organic acid that results in the better maintenance of gut eubiosis, efficient utilization of protein, and energy improved digestibility of nutrients.

Haemato-Biochemical Parameters

The results pertaining to haemato-biochemical parameters are presented in Table 2. The Hb, PCV, TLC, heterophils, lymphocytes, and H:L ratio of HE, OA, and HEOA groups showed no significant ($p < 0.05$) difference as compare to NC and PC group birds. The serum glucose and globulin level of HE, OA and HEOA groups were similar to PC group birds. Total serum protein level of HEOA group was significantly ($p < 0.05$) higher than NC and PC group birds. The albumin level was significantly ($p < 0.05$) higher in HEOA and HE groups as compared with PC and NC group birds. The A:G ratio of HE and HEOA groups showed a significantly ($p < 0.05$) higher value than NC, PC, and OA group birds. The serum cholesterol (mmol/l) level in natural growth promoter supplemented groups (HE, OA, and HEOA) were significantly ($p < 0.05$) lower than PC and NC group birds.

The present findings showed that haemato-biochemical parameters were in normal range, and non-antibiotic supplements had no detrimental effect on the normal metabolism and health of broilers. Khan *et al.* (2018) also reported non-significant ($p > 0.05$) variation in hematological parameters in broilers supplemented with the herbal mixture. In contrary to these results, Hasan *et al.* (2016) found that the inclusion of tulsi leaf (*Ocimum sanctum*) extract had a significant ($P < 0.05$) influence on hematological parameters such as TEC, ESR, and PCV. Shihab (2017) reported a substantial ($p < 0.05$) increase in the serum glucose level with supplementation of 2 g/kg neem in broilers. The findings of total serum protein were in harmony with Khan et al. (2012), who found increased total protein values in broilers supplemented with 2.5 and 5.0% black cumin seeds. Decreased serum cholesterol level in non-antibiotic supplemented group broilers was in harmony with the previous findings of Kamal and Ragaa (2014) and Khan *et al.* (2018).

Carcass Characteristics

The carcass characteristics of broilers are given in Table 3. The dressed weight of HE, OA, and HEOA supplemented group broilers was similar to PC group, however significantly ($p < 0.05$) lower to NC group birds. The eviscerated weight, drawn yield, heart weight, liver weight, and giblet weight of HE, OA, and HEOA groups were similar to NC and PC groups.

Table 2: Haemato-biochemical profile of broilers fed alcoholic extract of phytobiotic mixture and organic acid

Attributes	*NC*	*PC*	*HE*	*OA*	*HEOA*	*SEM*	*p-value*
Hb (g/dl)	8.90	7.85	9.40	8.70	8.90	0.254	0.444
PCV (%)	32.00	28.50	32.25	28.25	30.25	1.321	0.841
TLC (x 10^3/mm^3)	26.03	24.67	24.35	25.68	25.11	0.331	0.511
Heterophils (x10^3/mm^3)	8.51	8.30	7.71	8.53	8.18	0.194	0.714
Lymphocytes (x10^3/mm^3)	14.26	13.78	13.51	13.98	13.61	0.205	0.830
H/L Ratio*	0.60	0.61	0.57	0.61	0.60	0.016	0.941
Glucose (mmol/l)	7.37^{b}	8.99^{a}	9.45^{a}	9.97^{a}	9.16^{a}	0.250	0.003
Total protein (g/l)	44.72^{c}	51.09^{bc}	55.20^{ab}	53.96^{ab}	60.33^{a}	1.453	0.002
Albumin (g/l)	15.39^{c}	16.81^{c}	22.81^{ab}	19.32^{bc}	25.21^{a}	1.049	0.003
Globulin (g/l)	29.33^{b}	34.28^{a}	32.38^{a}	34.64^{a}	35.12^{a}	0.604	0.002
A:G ratio	0.52^{b}	0.49^{b}	0.70^{a}	0.5550^{b}	0.71^{a}	0.027	0.003
Cholesterol (mmol/l)	1.72^{b}	1.98^{a}	1.38^{c}	1.29^{c}	1.27^{c}	0.068	<0.001

Means with different superscripts in a row between groups differ significantly ($p < 0.05$).
*Heterophil to Lymphocyte ratio

Table 3: Carcass characteristics of broilers fed alcoholic extract of phytobiotic mixture and organic acid

Attributes	*NC*	*PC*	*HE*	*OA*	*HEOA*	*SEM*	*p-value*
Dressed weight (%)	90.24^{a}	87.23^{b}	87.42^{b}	87.47^{b}	86.01^{b}	0.389	0.002
Eviscerated weight (%)	75.51	76.28	76.43	77.09	74.81	0.331	0.231
Drawn yield (%)	79.60	79.89	80.37	81.03	78.60	0.325	0.178
Heart weight (%)	0.50	0.58	0.52	0.54	0.55	0.011	0.139
Liver weight (%)	1.97	1.56	1.72	1.67	1.68	0.047	0.069
Gizzard weight (%)	1.63^{ab}	1.46^{c}	1.70^{ab}	1.74^{a}	1.56^{bc}	0.030	0.012
Giblet weight (%)	4.09	3.61	3.94	3.94	3.79	0.061	0.119
Thigh weight (%)	9.63^{b}	11.00^{a}	11.10^{a}	10.84^{a}	11.39^{a}	0.198	0.029
Drumstick weight (%)	8.32^{cd}	8.98^{bc}	8.01^{d}	9.51^{ab}	9.97^{a}	0.202	0.001

Means with different superscripts in a row between groups differ significantly ($p < 0.05$).

Gizard weight of OA group was significantly ($p < 0.05$) higher as compared with PC and similar to NC group broilers. Thigh weights of all treated groups were similar to PC and significantly ($p < 0.05$) higher than NC group. Drumstick weight of HEOA group was significantly ($p < 0.05$) higher than NC group birds. The non-significant variations on carcass parameters were in agreement to the findings of Gomathi *et al*. (2018) that supplemented cinnamon oil and sodium butyrate in broilers diet. However, Mohamed *et al*. (2018) showed that dressed carcass weight was significantly higher ($p < 0.05$) in organic acid mixtures supplemented groups as compared to control.

Conclusion

On the basis of present findings, it was concluded that supplementation of alcoholic extract of 1% phytobiotic mixture with 0.1% organic acid in broilers diet improved performance of birds and had no detrimental effect on bird's health. Therefore, considering the harmful effect of antibiotic growth promoter on consumer's health, the use of phytobiotic mixture with OA can be recommended to use as growth promoter in broiler production.

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