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Effect of *Aloe vera* and *Curcuma longa* (Turmeric) on Carcass Characteristics and Biochemical Parameters of Broilers

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Abstract: An experiment was conducted to study the inclusion of *Aloe vera* and *Curcuma longa* and its combinations on production performance, viz., weight gain, feed intake and feed conversion ratio, carcass characteristics and biochemical parameters for a period of six weeks with two hundred and eighty commercial, straight run day-old Vencobb broiler chicks. These chicks were randomly grouped into seven treatments with four replicates of ten chicks each. The treatment groups consisted of control (T_1), 0.1 percent *Aloe vera* powder (T_2), 0.2 percent *Aloe vera* powder (T_3), 0.1 percent *Curcuma longa* powder (T_4), 0.2 percent *Curcuma longa* powder (T_5) and 0.1 percent of *Aloe vera* and 0.1 percent of *Curcuma longa* powder (T_6) and 0.2 percent of *Aloe vera* and 0.2 percent of *Curcuma longa* powder (T_7) included in the broiler diet. The abdominal fat percentage, breast and thigh muscle cholesterol showed no significant difference between treatment groups. The serum glucose, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides level did not differ significantly between treatment groups. Haemagglutination inhibition titre against Newcastle disease revealed significant difference ($P < 0.01$) between treatment groups. T_2 and T_3 showed higher titre value when compared with control.

Key words: Broilers, carcass characteristics, biochemical parameters

Introduction

Aloe vera and *Curcuma longa* (Turmeric) are the two medicinal plants found in tropical regions of India and are commonly incorporated in most of the poultry herbal medicines like liver tonics, anti-stress, antioxidants, antitoxic and growth promoting preparations. Apart from these benefits, these two herbs are used for various functions like antibacterial, antiseptic, anti-inflammatory, nematocidal and immunomodulatory properties.

Besides, usage of these herbs for medicinal preparations, it can also be included in the poultry diet as feed additive to utilize their benefits to the maximum extent. Hence, this research work was designed in broilers by including different levels of *Aloe vera*, *Curcuma longa* and their combinations to study the carcass characteristics and serum biochemical parameters in broilers.

Materials and Methods

Experimental design: Two hundred and eighty commercial, straight run day-old Vencobb broiler chicks belonging to single hatch were purchased from local hatchery, wing banded, weighed and randomly allotted into seven treatment groups with four replicates of ten chicks each. The chicks were reared in broiler cages in a gable roofed, open sided house. All the chicks were provided with uniform floor, feeder and waterer space and were reared under standard management conditions throughout the experimental period of six weeks.

Experimental diet: The experimental diet was formulated according to the standards prescribed in Bureau of Indian Standards (B.I.S., 1992). *Aloe vera* and *Curcuma longa* powder was included in the basal diet and the following experimental groups were formed.

Treatments	Experimental diets
T_1	Control
T_2	0.1 percent *Aloe vera* powder
T_3	0.2 percent *Aloe vera* powder
T_4	0.1 percent *Curcuma longa* powder
T_5	0.2 percent *Curcuma longa* powder
T_6	0.1 percent of *Aloe vera* and 0.1 percent of *Curcuma longa* powder
T_7	0.2 percent of *Aloe vera* and 0.2 percent of *Curcuma longa* powder

The broiler starter and finisher diets were fed *ad libitum* to the birds from 1-28 and 29-42 days of age, respectively.

The diets were subjected to proximate analysis as per AOAC (1995). The ingredients and nutrient composition of the experimental broiler starter and finisher diet are presented in Table 1.

Collection of data: Data on body weight, feed consumption were recorded at weekly intervals and mortality was recorded at occurrence. From the above data, body weight gain, feed efficiency and livability were calculated.

Table 1: Ingredients and nutrient composition (%DM) of broiler starter and finisher ration

Ingredients	Broiler starter	Broiler finisher
Maize	58.0	62.1
Soya	38.0	33.0
Calcite	2.5	2.6
DCP	1.5	1.5
Crude rice bran oil	-	0.8
Total	100.0	100.0
Supplements		
Vitamins AB_2D_3K[1]	0.010	0.010
B-Complex[2]	0.020	0.020
Trace minerals[3]	0.100	0.100
Lysine	0.050	0.050
Methionine	0.200	0.200
DOT[4]	0.050	0.050
Salt	0.350	0.350
Endox[5]	0.050	0.050
Toxin binder[6]	0.025	0.025
Total	0.855	0.855
Nutrients		
Crude protein	22.32	20.44
M.E (kcal/kg)*	2864	2944
Crude fibre	3.58	3.45
Ether extract	2.60	2.53
Total ash	6.68	6.76
Nitrogen free extract*	64.82	66.82
Calcium	1.06	1.05
Total Phosphorus	0.68	0.69
Lysine*	1.59	1.44
Methionine*	0.38	0.35

*Calculated values: [1]One gram of vitamin AB_2D_3K supplement contained 82500 IU of vitamin-A, 50 mg of vitamin-B_2, 12000 IU of vitamin-D_3 and 10 mg of vitamin-K. [2] One gram of B-complex supplement contained 80 mg of vitamin-B_1,16 mg of vitamin-B_6, 80 mcg of vitamin-B_{12}, 80 mg of vitamin-E, 120 mg of niacin, 8 mg of folic acid, 80 mg of calcium pantothenate and 86 mg of calcium. [3] One gram of trace minerals contained 54 mg of manganese, 52 mg of zinc, 20 mg of iron, 2 mg of iodine and 1 mg of cobalt. [4]One gram of DOT contained Dinitro-ortho-toluamide 25 mg w/w. [5]Ethoxyquin, BHT and chelating agents. [6]Hydrated sodium alumino silicate (HSCAS), organic acids, vinylpyrrolidone homopolymer, mannanoligosaccharide (MOS) activated charcoal and lipotropic factors.

Carcass characteristics: At the end of 42nd day of age, one male and one female from each replicate, totally eight birds per treatment group were randomly picked up, blood samples were collected for measuring the serum biochemical characteristics and slaughtered as per the method of Arumugam and Panda (1970). The pre-slaughter live weight, New York dressed weight, eviscerated carcass weight, giblets weight, ready-to-cook carcass weight and abdominal fat weight were recorded. Ready-to-cook yield and abdominal fat percentage were calculated on live weight basis. The thigh and breast muscle samples were collected from each carcass and stored at -20^{o}C for estimation of total meat cholesterol.

Muscle cholesterol: The meat samples were chopped and minced with mortar and pestle. The total lipid was extracted from the muscle samples as per the method of Folch *et al.* (1957) and the total meat cholesterol was estimated by one-step method of Wybenga *et al*. (1970).

Serum biochemistry: Blood samples collected from eight birds randomly picked up for slaughter from each treatment group were allowed to clot and centrifuged for 20 min at 1500 rpm to separate the sera. The sera samples were stored at -20^{o}C for the analysis of serum glucose, total cholesterol, HDL cholesterol, and triglycerides as per the following procedures. LDL cholesterol was calculated by using values of total cholesterol, HDL and triglycerides.

Immunological study: Blood samples were collected at the end of sixth week and serum was separated. The antibody titre in the serum was detected by haemagglutination test (Alexander, 1998).

Statistical analysis: The data collected on various parameters were subjected to statistical analysis using Completely Randomized Design (CRD) as per the methods suggested by Snedecor and Cochran (1989). Angular transformation was applied to percentages wherever needed.

Results and Discussion

Carcass characteristics:

Carcass yield: Statistical analysis of data on carcass characteristics revealed no significant difference among treatment groups due to dietary inclusion of *Aloe vera* and *Curcuma longa* and its combinations. The carcass characteristics viz. pre-slaughter, New York dressed, eviscerated weights, ready-to-cook percentage and giblets weight did not differ significantly between the treatment groups. The ready-to-cook percentage was almost similar in all treatment groups (77 percent) which clearly indicates that *Aloe vera* and *Curcuma longa* have no effect on carcass yield of broilers.

This finding favourably compared with earlier reports of Sinurat *et al.* (2002) who stated that supplementation of fresh *Aloe vera* gel (0.25 g/kg) and dry *Aloe vera* gel (0.25 and 1.0 g/kg) in broiler diet from 1-day old to 5 weeks of age showed no significant effect on carcass yield and internal organs.

On the contrary, Durrani *et al.* (2006) reported higher (55 percent) dressing percentage, breast, thigh and giblet weight in broilers fed diet containing 0.5 percent turmeric. Similarly, Singh *et al.* (2007) also reported that supplementation of amla and turmeric powder (@ 5 g/kg of feed) in broiler diet improved dressing percentage in broilers

Abdominal fat percentage: The analysis of data on mean abdominal fat percentage revealed no significant difference between treatment groups by inclusion of *Aloe vera* and *Curcuma longa* and its combinations.

Table 2: Mean (±S.E.) carcass characteristics of broilers at 6 weeks of age fed diet with *Aloe vera* and *Curcuma longa* and its combinations

Treatments	Pre-slaughter live weight (g)	New York dressed weight (g)	Eviscerated carcass weight (g)	Ready-to-cook yield (%)
T1 Control	1849.75±56.90	1687.25±54.00	1482.75±49.07	77.27±0.53
T20.1% *Aloe vera*	1955.25±85.17	1784.75±75.51	1563.13±62.34	77.51±0.56
T3 0.2% *Aloe vera*	1839.50±61.88	1701.88±55.81	1493.63±52.75	77.85±0.45
T4 0.1% *Curcuma longa*	1917.88±65.60	1762.88±60.85	1540.75±60.18	77.38±0.45
T50.2% *Curcuma longa*	1940.13±38.80	1790.38±31.88	1554.25±27.14	77.43±0.58
T6 0.1%*Aloe vera*+0.1% *Curcuma longa*	1925.50±77.53	1777.13±74.74	1552.13±63.29	77.95±0.67
T70.2% *Aloe vera*+0.2% *Curcuma longa*	1956.00±94.51	1796.00±82.74	1556.88±73.66	77.59±0.55

Table 2: Continue

Treatments	Giblets (g)			Abdominal fat
	Gizzard	Liver	Heart	Percentage
T1 Control	42.25±1.24	39.00±1.75	9.88±0.52	0.88±0.12
T20.1% *Aloe vera*	46.25±2.62	40.25±1.96	10.25±0.31	0.91±0.10
T3 0.2% *Aloe vera*	40.50±2.65	37.38±1.95	8.38±0.50	1.12±0.33
T4 0.1% *Curcuma longa*	46.00±2.88	36.00±0.96	9.50±0.33	0.98±0.10
T50.2% *Curcuma longa*	48.13±1.47	38.88±1.59	8.88±0.23	0.94±0.10
T6 0.1%*Aloe vera*+0.1% *Curcuma longa*	45.25±2.09	36.25±2.53	8.75±0.65	0.72±0.11
T70.2% *Aloe vera*+0.2% *Curcuma longa*	44.63±3.70	37.50±3.22	9.13±0.55	0.86±0.06

Each value is a mean of 8 observations

Table 3: Mean (±S.E.) serum biochemical (mg/dl) profile of broilers at 6 weeks of age fed diet with *Aloe vera* and *Curcuma longa* and its combinations

Treatments	Glucose	Cholesterol			Triglycerides
		Total	HDL	LDL	
T1 Control	215.89 ±31.77	109.74 ±6.41	31.52 ±0.70	56.32 ±7.07	21.90 ±0.52
T2 0.1% *Aloe vera*	188.10 ±31.36	95.07 ±5.25	32.79 ±0.47	41.93 ±5.58	20.35 ±1.09
T3 0.2% *Aloe vera*	179.14 ±29.73	109.21 ±3.59	33.16 ±0.46	56.08 ±4.00	19.97 ±0.94
T4 0.1% *Curcuma longa*	241.94 ±43.82	107.90 ±4.97	33.37 ±0.72	53.92 ±4.80	20.60 ±0.61
T5 0.2% *Curcuma longa*	233.21 ±29.85	113.16 ±3.48	31.97 ±0.63	63.08 ±4.09	18.10 ±1.70
T6 0.1% *Aloe vera* + 0.1% *Curcuma longa*	188.78 ±23.60	110.20 ±4.05	32.52 ±0.76	58.41 ±4.12	19.27 ±0.72
T7 0.2% *Aloe vera* + 0.2% *Curcuma longa*	214.76 ±30.60	114.21 ±2.84	34.18 ±0.64	60.92 ±2.89	18.99 ±1.03

Each value is a mean of 8 observations

This finding favourably compared with earlier reports of Sinurat *et al.* (2002) who stated that supplementation of fresh *Aloe vera* gel (0.25 g/kg) and dry *Aloe vera* gel (0.25 and 1.0 g/kg) in broiler diet from 1-day old to 5 weeks of age showed no significant effect on abdominal fat levels.

On the contrary, Emadi and Kermanshahi (2006) who observed that the dietary inclusion of turmeric rhizome powder (0.75 percent and 0.5 percent) in broiler diets had significantly ($P < 0.05$) decreased the abdominal fat pad size.

Similarly, Samarasinghe *et al*. (2003) stated that supplementation of turmeric (3 g/kg and 1 g/kg of feed) markedly reduced fat content to 1.2 and 0.6 percent of body weight as compared to 1.91 and 1.22 percent, respectively in the control group.

Muscle cholesterol: The analysis of data on breast and thigh muscle cholesterol level revealed no significant difference between treatment groups by inclusion of *Aloe vera* and *Curcuma longa* and its combinations. The breast and thigh muscle cholesterol of broilers at six weeks of age was numerically low in all treatment groups when compared to control which clearly indicates that the *Aloe vera* and *Curcuma longa* have muscle cholesterol reducing effect when included in the broiler diet.

Serum biochemistry: Serum glucose, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides

Statistical analysis of data on serum biochemical parameters revealed no significant difference among the treatment groups by dietary inclusion of *Aloe vera* and *Curcuma longa* and its combinations. Analyses of variance of data on serum glucose, total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides level revealed no significant difference between treatment groups. The serum total cholesterol level of broilers fed with 0.1 percent *Aloe vera* was numerically low when compared to all other treatment groups. The mean serum HDL cholesterol was numerically high in T_7 compared to control. The mean serum glucose was lower in T_3, T_2 and T_6 compared to control.

This finding was consistent with Namagirilakshmi (2005) who stated that supplementation of turmeric in broiler chicken diet at 0.25, 0.50, 0.75 and 1.00 percent

Table 4: Mean (±S.E.) breast and thigh muscle cholesterol of broilers at 6 weeks of age fed diet with *Aloe vera* and *Curcuma longa* and its combinations

Treatments	Breast muscle cholesterol (mg/dl)	Thigh muscle cholesterol (mg/dl)
T1 Control	87.67±6.00	177.88±7.79
T2 0.1% *Aloe vera*	63.59±2.76	150.24±8.23
T3 0.2% *Aloe vera*	60.54±9.08	153.97±9.83
T4 0.1% *Curcuma longa*	72.41±7.41	144.53±8.47
T5 0.2% *Curcuma longa*	60.32±8.09	147.64±6.31
T6 0.1% *Aloe vera*+0.1% *Curcuma longa*	77.01±3.83	156.11±5.34
T7 0.2% *Aloe vera*+0.2% *Curcuma longa*	73.28±7.87	161.53 ±8.44

Each value is a mean of 8 observations

Table 5: Mean (±S.E.) Haemagglutination inhibition titre (log 2) of broilers at 6 weeks of age fed diet with *Aloe vera* and *Curcuma longa* and its combinations

Treatments	HI titre (log 2)
T1 Control	5.13^{abc}±0.23
T2 0.1% *Aloe vera*	5.38^{ab}±0.38
T3 0.2% *Aloe vera*	5.50^{a}±0.19
T4 0.1% *Curcuma longa*	3.38^{CD} ±0.26
T5 0.2% *Curcuma longa*	3.13^{d}±0.35
T6 0.1% *Aloe vera*+0.1% *Curcuma longa*	3.63^{CD}±0.32
T7 0.2% *Aloe vera*+0.2% *Curcuma longa*	4.38^{abcd}±0.32

Each value is a mean of 8 observations. A-D Means within a column with no common superscript differ significantly (P < 0.01)

levels had no significant effect on blood glucose, total cholesterol, HDL, LDL and triglycerides between treatment groups and control.

On the contrary, Emadi *et al*. (2007) observed significant (P < 0.05) increase in total cholesterol, HDL-cholesterol and decreased levels of LDL-cholesterol and VLDL-cholesterol and non-significant effect on total triglyceride at 42 days of age in male broiler chickens fed with diet containing turmeric rhizome powder.

Similarly, Rajasekaran *et al.* (2006) stated that the oral administration of *Aloe vera* gel extract (300 mg/kg bodyweight per day) to streptozotocin (STZ) induced diabetic rats had a significant reduction in fasting glucose and an increased plasma levels of high density lipoprotein-cholesterol and decreased plasma levels of low-density lipoprotein and very low density lipoprotein-cholesterol.

Immunity: The analysis of data on haemagglutination inhibition titre revealed significant difference (P < 0.01) between treatment groups. T_2 and T_3 showed higher value when compared with control which might be due to dietary inclusion of *Aloe vera*. This finding was consistent with the Jagadeeswaran (2007) who reported that *Aloe vera* (1.0 and 0.1 percent) fed groups showed significantly (P < 0.05) higher titre values against Newcastle disease in broiler chickens at six weeks of age.

Similarly, Valle-Paraso *et al.* (2005) stated that oral supplementation of *Aloe vera* (*Aloe barbadensis*) showed increase in mean antibody titres to Newcastle Disease in broiler chickens.

In this experiment, the significant raise in titre value against Newcastle Disease was observed only when *Aloe vera* was included separately at 0.1 and 0.2 percent in broiler diet but not in combination with *Curcuma longa* during which the titre value was reduced compared to control.

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