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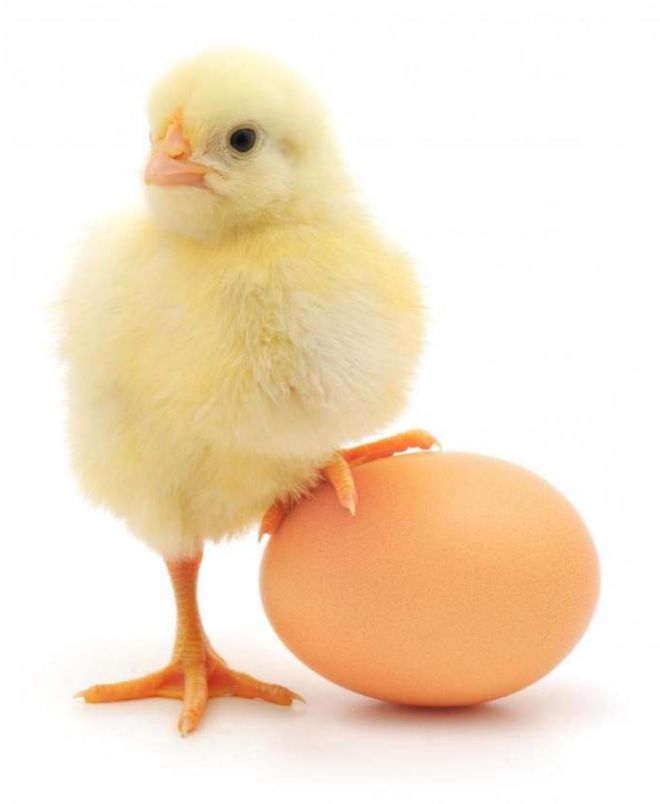

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Ginger, Pepper and Curry Leaf Powder as Feed Additives in Broiler Diet

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Abstract: Two hundred and ten 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 three 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. The treatments were T_1-Control; T_2-0.2% Ginger powder; T_3-0.2% Pepper powder; T_4-0.2% Curry leaf powder; T_5-0.2% Ginger + 0.2% pepper; T_6-0.2% Ginger + 0.2% Curry leaf powder and T_7-0.2% Pepper + 0.2% Curry leaf powder. The mean body weight (g/bird) of broilers at 6 weeks of age fed with different inclusion levels of dried ginger, pepper and curry leaf powder differ significantly ($p<0.05$) among treatment groups at six weeks of age. The feed conversion ratio was significantly ($p<0.01$) superior in ginger-curry leaf (T_6) and pepper-curry leaf powder (T_7) fed groups compared to control. But the feed consumption did not differ significantly among treatment groups because of isocaloric and isonitrogenous diet. The mean return over feed cost of T_2 and T_5 was significantly ($p<0.01$) higher when compared to other treatment groups at sixth week of age. The carcass characteristics viz. pre-slaughter, New York dressed, eviscerated weights, ready-to-cook percentage, abdominal fat percentage and giblets weight did not differ significantly between the treatment groups fed different levels of dried ginger, pepper and curry leaf powder from 1-6 weeks of age.

Key words: Broilers, ginger, pepper, curry leaf

INTRODUCTION

Ginger, pepper and curry leaf are common medicinal herb used in human diet. These three herbs are known spices which improves digestibility. The same property can be used in poultry to increase the feed conversion ratio which results in increased body weight and more profit. Based on this objective a research trial was conducted in broilers by including dried ginger, pepper and curry leaf powders as feed additive at different levels in broiler diet.

MATERIALS AND METHODS

Two hundred and ten 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 three 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). Dried ginger, pepper and curry leaf powder was included in the basal diet and the following experimental groups were formed.

Treatments	Experimental diets
T_1	Control
T_2	0.2% Ginger powder
T_3	0.2% Pepper powder
T_4	0.2% Curry leaf powder
T_5	0.2% Ginger + 0.2% pepper
T_6	0.2% Ginger + 0.2% Curry leaf powder
T_7	0.2% Pepper + 0.2% Curry leaf 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.

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 and slaughtered as per the method of Arumugam and Panda (1970). The pre-slaughter live weight, New York dressed weight, eviscerated carcass weight, giblets

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

Ingredients	Broiler starter	Broiler finisher
Maize	57.0	63.0
Soya	39.0	32.0
Calcite	2.5	2.7
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	22.12	20.53
M.E (kcal/kg)*	2851	2861
Crude fibre	3.45	3.22
Ether extract	2.58	2.62
Total ash	6.71	6.63
Nitrogen free extract*	64.54	66.84
Calcium	1.09	1.04
Total Phosphorus	0.64	0.61
Lysine*	1.42	1.62
Methionine*	0.41	0.39

*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

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.

Return over feed cost: Return over feed cost of broilers reared under different inclusion levels of dried ginger, pepper and curry leaf powder was worked out by using the prevailing market rates.

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

Body weight: The mean body weight (g/bird) of broilers at 6 weeks of age (Table 2) fed with different inclusion levels of dried ginger, pepper and curry leaf powder differ significantly ($p<0.05$) among treatment groups at six weeks of age. There was a proportionate increase in body weight in groups fed with graded levels of dried ginger powder either alone or in combination with curry leaf when compared to control which might be due to the antioxidant property of curry leaf powder and increased digestibility property of ginger included in the broiler diet, which was similar to the findings of Ademola *et al.* (2009) and Onimisi *et al.* (2005) who observed that ginger increased body weight when included in the diet up to 2% level in the diet. This was contrary to the findings of Garcia *et al.* (2007); Ghazaiah *et al.* (2007) and Tollba *et al.* (2007).

Feed consumption: The mean cumulative feed consumption (g/bird) of broilers as influenced by dietary inclusion of dried ginger, pepper and curry leaf powder is furnished in Table 3. Analysis of data on mean

Table 2: Mean (±S.E.) body weight (g/bird) of broilers fed diet with dried powder of ginger, pepper, curry leaf and its combinations

Treatments	Hatch weight	I Week	II Week	III Week
T_1 Control	46.12±0.32	165.23±1.87	378.25±3.56	757.41±9.73
T_2 0.2% Ginger powder	46.34±0.34	163.28±2.10	366.99±8.35	46.34±0.34
T_3 0.2% Pepper powder	46.12±0.43	162.28±2.10	366.99±8.35	682.05±10.91
T_4 0.2% Curry leaf powder	47.16±0.63	160.28±2.10	360.28±2.10	682.05±10.91
T_5 0.2% Ginger + 0.2% pepper	46.01±0.59	167.28±2.10	361.53±6.09	669.81±10.59
T_6 0.2% Ginger + 0.2% Curry leaf powder	45.21±0.46	154.82±2.01	376.31±4.76	701.05±10.91
T_7 0.2% Pepper + 0.2% Curry leaf powder	45.05±0.56	169.05±1.99	365.49±3.99	710.55±9.59
Treatments	Hatch weight	IV Week	V Week	VI Week
T_1 Control	46.12±0.32	1090.78±16.39	1434.64±53.23	1867.14^{a}±47.38
T_2 0.2% Ginger powder	46.34±0.34	1149.75±21.32	1475.72±29.16	1898.66^{b}±42.68
T_3 0.2% Pepper powder	46.12±0.43	1130.75±21.32	1465.72±29.16	1878.66^{b}±42.68
T_4 0.2% Curry leaf powder	47.16±0.63	1099.75±21.32	1465.72±29.16	1868.66^{a}±42.68
T_5 0.2% Ginger + 0.2% pepper	46.01±0.59	1125.90±16.47	1465.06±21.19	1847.11^{a}±29.62
T_6 0.2% Ginger + 0.2% Curry leaf powder	45.21±0.46	1153.94±21.62	1432.72±29.16	1898.11^{b}±39.14
T_7 0.2% Pepper + 0.2% Curry leaf powder	45.05±0.56	1125.94±17.68	1451.45±24.76	1854.53^{a} ±24.71

Each value is a mean of 40 observations, $^{a-b}$Means within a column with no common superscript differ significantly ($p<0.05$)

Table 3: Mean (±S.E.) cumulative feed consumption (g/bird) of broilers fed diet with dried powder of ginger, pepper, curry leaf and its combinations

Treatments	I Week	II Week	III Week
T_1 Control	137.21±1.56	487.53±2.15	1102.60±12.01
T_2 0.2% Ginger powder	136.95±1.32	484.15±2.16	1121.16±24.40
T_3 0.2% Pepper powder	139.52±1.99	483.57±5.75	1134.28±17.03
T_4 0.2% Curry leaf powder	137.30±3.22	485.83±11.01	1105.48±32.94
T_5 0.2% Ginger + 0.2% pepper	132.04±1.35	491.22±2.74	1076.65±6.60
T_6 0.2% Ginger + 0.2% Curry leaf powder	131.12±2.32	490.49±4.92	1099.68±14.02
T_7 0.2% Pepper + 0.2% Curry leaf powder	134.08±1.41	493.40±1.76	1098.22±4.26
Treatments	IV Week	V Week	VI Week
T_1 Control	1839.56±29.33	2656.16±25.48	3486.14±38.49
T_2 0.2% Ginger powder	1814.26±59.42	2698.54±81.63	3427.34±81.94
T_3 0.2% Pepper powder	1854.36±38.91	2672.75±35.81	3548.91±32.82
T_4 0.2% Curry leaf powder	1862.43±60.33	2684.67±75.80	3537.22±110.70
T_5 0.2% Ginger + 0.2% pepper	1827.07±19.14	2663.96±28.11	3590.16±54.19
T_6 0.2% Ginger + 0.2% Curry leaf powder	1841.71±54.67	2621.39±70.49	3478.57±114.55
T_7 0.2% Pepper + 0.2% Curry leaf powder	1856.28±17.04	2645.93±25.53	3414.61±50.23

Each value is a mean of 4 observations

Table 4: Mean (±S.E.) cumulative feed conversion ratio of broilers fed diet with dried powder of ginger, pepper, curry leaf and its combinations

Treatments	I Week	II Week	III Week	IV Week	V Week	VI Week
T_1 Control	1.13±0.02	1.54±0.02	1.62±0.02	1.69±0.02	1.82±0.02	1.91^{A}±0.01
T_2 0.2% Ginger powder	1.21±0.07	1.54±0.06	1.59±0.01	1.69±0.06	1.89±0.01	1.92^{A}±0.03
T_3 0.2% Pepper powder	1.22±0.02	1.58±0.01	1.61±0.06	1.69±0.02	1.84±0.02	1.96^{B}±0.07
T_4 0.2% Curry leaf powder	1.19±0.02	1.57±0.05	1.60±0.03	1.64±0.04	1.87±0.03	1.92^{A}±0.02
T_5 0.2% Ginger + 0.2% pepper	1.23±0.01	1.59±0.02	1.67±0.07	1.72±0.02	1.89±0.04	1.95^{B}±0.04
T_6 0.2% Ginger + 0.2% Curry leaf powder	1.15±0.03	1.54±0.02	1.65±0.01	1.64±0.03	1.81±0.02	1.90^{A}±0.05
T_7 0.2% Pepper + 0.2% Curry leaf powder	1.15±0.04	1.54±0.02	1.69±0.03	1.74±0.02	1.87±0.04	1.89^{A}±0.05

Each value is a mean of 4 observations, $^{A-B}$Means within a column with no common superscript differ significantly ($p<0.01$)

Table 5: Mean (±S.E.) return over feed cost (Rs./kg live weight) of broilers fed diet with dried powder of ginger, pepper, curry leaf and its combinations

Treatments	Cost of feed/kg (Rs.)	I Week	II Week	III Week
T_1 Control	15.55	3.15±0.08	6.48±0.12	12.13±0.29
T_2 0.2% Ginger powder	15.70	2.58±0.10	5.79±0.15	11.34±0.39
T_3 0.2% Pepper powder	15.74	2.61±0.10	5.80±0.15	11.57±0.39
T_4 0.2% Curry leaf powder	15.50	2.48±0.12	5.69±0.24	10.02±0.57
T_5 0.2% Ginger + 0.2% pepper	15.85	2.58±0.10	5.79±0.15	11.34±0.39
T_6 0.2% Ginger + 0.2% Curry leaf powder	15.78	2.77±0.07	5.51±0.21	21.83±0.40
T_7 0.2% Pepper + 0.2% Curry leaf powder	15.80	2.57±0.08	5.21±0.07	10.21±0.04
Treatments	Cost of feed/kg (Rs.)	IV Week	V Week	VI Week
T_1 Control	15.55	18.21^{A}±0.37	21.52±0.49	23.52^{B}±0.32
T_2 0.2% Ginger powder	15.70	17.83^{A}±0.38	21.17±1.01	25.24^{A}±0.40
T_3 0.2% Pepper powder	15.74	16.74^{B}±0.38	18.17±1.01	23.93^{A}±0.40
T_4 0.2% Curry leaf powder	15.50	15.67^{B}±0.17	16.54±0.23	21.24^{B}±0.40
T_5 0.2% Ginger + 0.2% pepper	15.85	16.87^{B}±0.35	19.76±1.06	24.16^{A}±0.65
T_6 0.2% Ginger + 0.2% Curry leaf powder	15.78	17.13^{A}±0.38	19.50±0.24	21.78^{B}±0.67
T_7 0.2% Pepper + 0.2% Curry leaf powder	15.80	15.62^{B}±0.80	16.17±0.56	20.80^{B}±1.69

Each value is a mean of 4 observations, $^{A-B}$Means within a column with no common superscript differ significantly ($p<0.01$)

cumulative feed consumption revealed no significant difference between treatment groups from first to sixth week which might be due to isocaloric and isonitrogenous diet fed through out the experiment. The feed consumption was numerically high in control group compared to other treatment groups at sixth week of age. This was contrary to the findings of Ademola *et al.* (2009); Doley *et al.* (2009) who observed no difference in feed intake in broilers fed with ginger and pepper extract for a period of six weeks.

Feed Conversion Ratio (FCR): The mean cumulative feed conversion ratio (Table 4) of broilers fed with different levels of dried ginger, pepper and curry leaf powder differ significantly at 6^{th} week of age. The feed conversion ratio was significantly ($p<0.01$) superior in ginger-curry leaf (T_6) and pepper-curry leaf powder (T_7) fed groups compared to control which was in agreement with the findings of Onimisi *et al.* (2005) who stated that feed conversion ratio was significantly ($p<0.05$) improved when broilers were with graded levels of ginger waste meal from 10-40%. This was also similar to the findings of Vogt *et al.* (1989); Garcia *et al.* (2007); Fotea and Macovel (2005) and Tollba *et al.* (2007).

Return over feed cost: Analysis of variance of data on mean return over feed cost (Table 5) differs significantly between treatment groups at fourth and sixth weeks of age. The mean return over feed cost of T_2 and T_5 was significantly ($p<0.01$) higher when compared to other treatment groups at sixth week of age.

Table 6: Mean (±S.E.) carcass characteristics of broilers at 6 weeks of age fed diet with dried powder of ginger, pepper, curry leaf and its combinations

Treatments	Pre-slaughter live weight (g)	New York dressed weight (g)	Eviscerated carcass weight (g)	Ready-to-cook yield (%)
T_1 Control	1849.75±56.90	1687.25±54.00	1482.75±49.07	77.27±0.53
T_2 0.2% Ginger powder	1940.13±38.80	1790.38±31.88	1554.25±27.14	77.43±0.58
T_3 0.2% Pepper powder	1986.13±38.80	1698.38±31.88	1542.25±27.14	77.93±0.58
T_4 0.2% Curry leaf powder	1890.67±67.12	1650.78±42.81	1482.25±54.14	77.82±0.61
T_5 0.2% Ginger + 0.2% pepper powder	1952.13±41.80	1765.38±29.88	1562.25±27.14	76.11±0.72
T_6 0.2% Ginger + 0.2% Curry leaf powder	1937.50±65.53	1777.13±74.74	1579.13±52.29	76.21±0.59
T_7 0.2% Pepper + 0.2% Curry leaf powder	1964.21±43.21	1796.00±82.74	1570.88±42.66	78.12±0.43

Treatments	Giblets (g)			Abdominal fat percentage
	Gizzard	Liver	Heart	
T_1 Control	42.25±1.24	39.00±1.75	9.88±0.52	0.88±0.12
T_2 0.2% Ginger powder	48.13±1.47	38.88±1.59	8.88±0.23	0.94±0.10
T_3 0.2% Pepper powder	47.27±1.47	37.65±1.59	8.75±0.23	0.97±0.10
T_4 0.2% Curry leaf powder	45.63±1.23	37.15±1.65	8.75±0.75	0.84±0.23
T_5 0.2% Ginger + 0.2% pepper powder	42.29±1.65	38.88±1.59	9.10±0.23	0.89±0.13
T_6 0.2% Ginger + 0.2% Curry leaf powder	44.26±2.54	37.24±1.43	8.26±0.47	0.74±0.17
T_7 0.2% Pepper + 0.2% Curry leaf powder	45.72±2.27	38.23±2.56	8.59±0.17	0.86±0.07

Each value is a mean of 8 observations

Carcass characteristics: The carcass characteristics (Table 6) viz. pre-slaughter, New York dressed, eviscerated weights, ready-to-cook percentage, abdominal fat percentage and giblets weight did not differ significantly between the treatment groups fed different levels of dried ginger, pepper and curry leaf powder from 1-6 weeks of age. This was similar to the findings of El-Deck *et al.* (2003) who observed that there was no significant effect on dressing percentage of broilers fed with 0.1% ginger powder up to six weeks of age. But Tollba *et al.* (2007) stated that giblets weight improved in broilers fed with pepper at the rate of 5 g per kg of feed.

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