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Effect of cardamom (*Elettaria cardamomum*) and Ginger (*Zingiber officinale*) powder supplementation on growth performance and economic analysis in broiler

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Abstract

An experiment was conducted at Livestock Instructional Unit of Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli to determine the effect of supplementing cardamom (*Elettaria cardamomum*) and ginger (*Zingiber officinale*) powder on the growth performance and economic analysis of broiler chickens. 168 Day-old chicks were divided into six dietary treatments viz., T₀: control diet (no additive), T₁: Basal diet supplemented plus 1% cardamom powder, T₂: Basal diet supplemented plus 2% cardamom powder, T₃: Basal diet supplemented plus 3% cardamom powder, T₄: Basal diet supplemented plus 1% ginger powder, T₅: Basal diet supplemented plus 2% ginger powder and T₆: Basal diet supplemented plus 3% ginger powder with four replication and seven birds have each replication. Results of experiment showed significant difference ($P < 0.05$) in feed intake, live weight, body weight gain and feed conversion ratio between treatments. The study concluded that supplementation of cardamom powder at the rate of 1 per cent in broiler diet improved growth performance of broiler and economical and profitable for broiler production.

Keywords: Broilers, economic, FCR, herbal feed, weight gain

1. Introduction

Feed additives are primarily included to improve the efficiency of the bird's growth, prevent disease and improve feed utilization. Among all growth promoters, the most commonly used are antibiotics, although nowadays their use is decreasing towards total extinction [1]. Some growth promoters act as pro-nutrients because of the role they play in enhancing the physiology and microbiology of the animal. Many active ingredients from plant are considered as pro-nutrients and recently been tried in animal feeds [1].

Garlic is natural growth promoters can be potential alternatives for common artificial growth promoters like antibiotics [2]. Ginger has possessed antibacterial, antifungal, antiparasitic, antiviral, antioxidant, anticholesteremic, anti-cancerous, and vasodilator characteristics [3] and it has vast active ingredients e.g., *Borneol*, *Camphene*, *Citral*, *Eucalyptol*, *Linalool*, *Phellandrene*, *zingiberine*, *zingiberol* (*gingerol*, *zingirone* and *shogaol*) and *resin* [4]. It has antibacterial and anti-inflammatory actions, and ginger rhizome is known to lower blood cholesterol level in man. Different researchers have examined the effect of ginger on growth performance in broilers, and controversial results were reported.

Cardamom (*Elettaria cardamomum*) is primarily cultivated in Southern India, Sri Lanka, Tanzania, Guatemala and Morocco. *Elettaria cardamomum* have antibacterial, gram-negative bacterium. In Indian medicine cardamom is used as a digestive aid and for the treatment of intestinal gas [26]. Therefore, objectives of this study were to evaluate effect of herbal feed additives on growth performance of broiler under *Konkan* region of Maharashtra.

2. Materials and Methods

The present experiment was carried out at Livestock Instruction Unit of Department of Animal Husbandry and Dairy Science, Dr. B. S. Konkan Krishi Vidyapeeth Dapoli, Maharashtra during 30th September 2014 to 10th November 2014 under climatic temperature of 18 - 25°C and 60-65 per cent relative humidity.

2.1 Animal and dietary treatments

168 day-old broiler chicks (Vencob) were purchased from Venktershwara hatchery Pune, weighed (41.57 ± 0.45 g) and randomly allocated into seven treatment groups with four replicates and each replication have with six birds. The concentrations of the administered supplements in the seven experimental diets were as follows: control diet (no additive) T_0 ; basal diet supplemented 1% cardamom powder (T_1), 2% cardamom powder (T_2), 3% cardamom powder (T_3), 1% ginger powder (T_4), 2% ginger powder (T_5) and 3% ginger powder (T_6). Ginger and cardamom were obtained from the local market and powdered using a mixer grinder before adding to the experimental diets. Proximate analysis of ginger and cardamom powder were performed for the components of dry matter, crude protein, ether extract, crude fibre and ash, according to [5] procedures (Table 1). In Table 2 showed chemical composition of basal starter (1-18 days) and finisher (19- 42 days) diets. Diets formulated to meet the nutrient requirements of broilers according to the recommendations of Ross Broiler Manual [6]. Birds were vaccinated routinely against infectious New Castle Disease (*lasota*), Infectious Bursal Disease at day 8 and day 18, respectively through the eye drop and drinking water. The experimental diets and drinking water were provided *ad libitum* throughout the experimental period of six weeks. All the chickens were maintained at a uniform temperature and lighting control system during the whole period of study. Weekly growth of chicks and daily feed consumption in each group were recorded up to six week period. Feed conversion efficiency (FCE) was calculated as the ratio between unit feed consumed to unit body weight gain. The data generated from the experiment were subjected to statistical analysis using randomized block [7].

3. Results and Discussion

3.1 Chemical composition of experimental diets

The result of chemical composition of cardamom and ginger powder and broiler and finisher feed are presented in Table 1 and 2. The values for DM, EE, CP, CF, ash and NFE were 77.19, 10.87, 13.83, 17.65, 15.50 and 42.15%, respectively in cardamom powder. Composition of cardamom powder observed in the present investigation was in agreement with that reported by [8] and while the 79.30, 1.12, 4.33, 3.41, 4.78 and 86.36% of DM, EE, CP, CF, ash and NFE, respectively in ginger powder. These values were closely similar to the values reported by [9] for ginger powder.

3.2 Feed intake (g/bird)

Average total feed intake of experimental birds T_0 group was significantly ($P < 0.05$) higher as compared to cardamom and ginger supplemented groups. However, feed intake in T_2 and T_6 and T_3 and T_4 was similar and did not differ significantly. It has shown that there is adverse effect of smell and/or taste of cardamom and ginger on the palatability of feed in the diets of broilers. The statistical analysis revealed that differences in total feed consumption due to different treatments were highly significant ($P < 0.05$). Similarly, different workers have reported non-significant effect of cardamom and ginger supplementation on feed intake in broilers [10; 11]. The results are in agreement with different workers who has that reported that herbals supplementation in the broiler's diets had a significant positive effect on feed consumption [12, 13, 14].

3.3 Water consumption of birds

The average water consumption per bird at the end of experiment were 5512.25, 6064.05, 5783.58, 5735.42,

5690.96, 5941.93 and 5823.76 ml/bird/week for treatment T_0 , T_1 , T_2 , T_3 , T_4 , T_5 and T_6 , respectively. The statistical data revealed that differences in total water consumption due to different treatments were significant ($P < 0.05$). Control group (T_0) consumed significantly less water as compared to experimental groups. The average water consumption was highest (6064.05 ml) in 1% cardamom group. Whereas, lowest water consumption was observed in T_0 group (5512.25 ml/bird) when compared with others. The results are in agreement with different workers who has that reported that when the broilers brooded on floor consumed less water [15] and [16].

3.4 Live weight gain of birds

Total body weight gain (g) of experimental birds supplemented with 1 and 3 per cent of cardamom powder (T_1 and T_3) showed significantly ($p < 0.05$) higher values as compared to control (T_0) and experimental of cardamom (T_2) and ginger (T_4 , T_5 and T_6) supplemented group (Table 3). The improvement in weight gain of experimental birds fed with garlic powder may be due to the action of antibacterial, gram-negative bacterium responsible for inhibition of pathogenic bacteria and fungi results into the improved gut environment [8] and [17] and [18] also reported significant improvement in body weight after supplemented with different levels of ginger powder. Improvement in body weight gain of broiler chicks fed on ginger might be due to the active components present in the ginger which stimulates digestive enzymes and improves overall digestion and thus leads to increased body weight gain. It has been established fact that ginger in the diets stimulate lactic acid bacteria and decreases pathogenic bacteria such as mesophilic aerobic, coliform and *Escherichia coli* and thus improves absorption of nutrients leads to better weight gain of the birds [19]. Overall, it showed that addition of 1% cardamom was significantly superior over ginger and basal diet too.

3.5 Average feed conversion ratio (FCR)

Experimental birds in T_0 group showed significantly ($p < 0.05$) higher average FCR as compare to T_1 , T_2 , T_3 , T_4 , T_5 and T_6 groups (Table 2). However, FCR in T_2 and T_3 and T_3 and T_6 was similar and did not differ significantly. On the basis of this, it can be inferred that supplementation of 1.0% ginger powder or 2.0% cardamom powder are equally effect on FCR as compared to control (T_0). Although, better FCR was observed in T_2 , followed by T_4 , T_3 , T_6 , T_1 , T_5 and T_0 group. These results are in accordance with the findings of [20] for cardamom, [21] and [22] for ginger reported significantly improved feed conversion ratio than control.

3.6 Mortality Rate

The average mortality rate in present experiment higher recorded in T_0 (8.47%) as compared to other experimental groups. The experimental group T_2 and T_4 was not found any mortality rate; however, the percentage was within the standard range. Improvement in mortality rate of broilers fed with ginger might be due to the stimulated lactic acid bacteria and decreases pathogenic bacteria such as mesophilic aerobic, coliform and *Escherichia coli* [19]. The results are consistent with those of [23] and [24] indicated that supplementation of ginger decreases the mortality rate in broiler than control group but [25] and [21] who did not observe any positive affect of ginger supplementation on mortality rate of broilers.

3.7 Cost of broiler production

The cost benefit analysis per bird is presented in Table 4. The total cost per kg broiler chicken production was lower in the treatment groups than control (T₀). However, the use of cardamom powder at 1.0 per cent level (T₁) group was found most economical in terms of production. The net profits per bird and per kg live weight were also more in T₁ groups as compared to control (T₀). These findings corroborated with the earlier findings of [26]. Increase in profit margin of the birds fed rations supplemented with a mixture of cardamom powder may be attributed to the better efficiency of feed utilization which resulted in more growth and better feed to

gain ratio, ultimately leading to higher profit margin in broilers.

Table 1: Chemical composition of experimental feed (% dry matter basis)

Item	Experimental feed	
	Broiler starter	Broiler finisher
DM	90.11	87.02
CP	20.74	19.10
EE	4.08	4.55
CF	6.33	5.41
NFE	67.61	69.72
Ash	1.24	1.22

Table 2: Chemical composition of cardamom and ginger powder (% dm basis).

Item	Experimental feed additives	
	Cardamom powder	Ginger powder
DM	77.19	79.30
CP	13.83	4.33
EE	10.87	1.12
CF	17.65	3.41
NFE	42.15	86.36
Ash	15.50	4.78

DM= Dry matter, CP=Crude protein, EE=Ether extract, CF= Crude fibre, NFE = Nitrogen free extract

Table 3: Average body weight gain, feed consumption, water intake, FCR and mortality rate of broilers.

Parameters	Control	Cardamom powder			Ginger powder		
	T ₀	T ₁ (1%)	T ₂ (2%)	T ₃ (3%)	T ₄ (1%)	T ₅ (2%)	T ₆ (3)
Body weight of DOC (g)	40.83	42.75	41.09	41.33	41.75	41.33	42.00
Final body weight (g)	1482.17 ^g	2030.09 ^a	1931.41 ^c	1951.59 ^b	1875.25 ^f	1860.84 ^e	1895.09 ^d
Average final body weight gain (g)	1441.34 ^g	1987.34 ^a	1890.32 ^c	1910.26 ^b	1833.50 ^e	1819.09 ^f	1853.09 ^d
Average daily BW gain (g)	34.31	47.31	45.01	45.48	43.65	43.31	44.12
Average weekly body weight (g)	240.22	331.22	315.05	318.37	305.58	303.18	308.84
Average feed intake (g)	3245.27 ^a	3229.01 ^b	2946.75 ^{ef}	3032.09 ^c	2869.47 ^g	3027.38 ^{cd}	2948.01 ^e
Average water intake capacity (ml)	5512.25 ^g	6064.05 ^a	5783.58 ^d	5735.42 ^c	5690.96 ^f	5941.93 ^b	5823.76 ^c
Feed conversion ratio	2.25 ^a	1.62 ^c	1.55 ^{ef}	1.58 ^{ed}	1.56 ^e	1.66 ^b	1.59 ^d
Mortality	2/24	1/24	0/24	1/24	0/24	1/24	1/24
Mortality rate	8.33	4.15	0.0	4.15	0.0	4.15	4.15
Livability	91.67	95.85	100	95.85	100	95.85	95.85

(^{abcdef} means with different superscripts differ significantly at $P < 0.05$)

Table 4: Effect of herbal feed additives on economics of broiler production.

Item/Expenditure	Control	Cardamom			Ginger		
	T ₀	T ₁ (1%)	T ₂ (2%)	T ₃ (3%)	T ₄ (1%)	T ₅ (2%)	T ₆ (3%)
Cost/bird	25	25	25	25	25	25	25
Cost/bird (Rs.30.30/kg)	98.48	97.87	89.39	91.81	86.96	91.81	89.39
Cost of natural herbals/bird	0.00	25.83	47.15	72.77	13.27	27.25	38.74
Miscellaneous (Rs.)	14	14	14	14	14	14	14
Total cost of production /bird (Rs.)	137.48	162.70	175.54	203.58	139.23	158.06	167.13
Receipt							
Through sale/bird @ Rs. 100/kg	152.00	207.00	197.00	199.00	192.00	190.00	194.00
Sale of other	5.50	5.50	5.50	5.50	5.50	5.50	5.50
Total receipt	157.50	212.50	202.50	204.50	197.50	195.50	199.50
Net profit/broiler	20.02	49.80	26.96	0.92	58.27	37.44	32.37
Net profit/kg live weight	10.98	24.53	13.95	0.47	31.06	20.11	17.08

4. Conclusion

It was concluded that supplementation of cardamom powder at the rate of 1 per cent per bird daily in the diet of broiler ration is more economical in terms of growth performance with good economic return on production of broilers.

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