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Effect of thyme essential oil on performance of broiler chicken

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Abstract
The present study was conducted to evaluate the Effect of Thyme essential oil on Performance of Broiler Chicken. Two hundred fourty Mareks disease vaccinated straight run day-old commercial broiler chicks were equally and randomly distributed into four treatment groups which were subdivided into three replicates containing 20 chicks in each, reared on deep litter system in pens up to 6 weeks of age. The dietary treatment groups were the Control diet without Thyme essential oil (A), Broiler ration containing Thyme essential oil, 100 mg/kg diet (B), Broiler ration containing Thyme essential oil, 200% mg/kg diet (C). Broiler ration containing Thyme essential oil, 300 mg/kg diet (D). The significant (P<0.05) body weight and gain in weight was observed in broiler ration containing Thyme 100 mg/kg diet. Feed intake and feed efficiency were found to be non significant in all the treatment groups. The better livability percent was observed in all thyme oil supplemented groups. The higher net profit was obtained in group B. In conclusion, the feed supplemented with thyme essential oil at 100mg/kg resulted in significantly higher body weight gain, improved feed conversion ratio, livability and profit in broiler production.

Keywords: Broiler, thyme, essential oil, performance

Introduction
The plant-derived products such as essential oils, herbs and oleoresins added to the diet of commercial poultry to improve their productivity through enhancing feed properties and promoting production performance [1]. Essential oils (EO) are very complex mixtures of naturally occurring compounds that have shown to improve intestinal health and benefit performance of broilers [2]. The dietary supplementation of essential oils to poultry has shown to stimulate the production of endogenous enzymes, enhanced feed digestion and thus less substrate is available for microbial fermentation. Essential oils have also demonstrated to modulate positively the microbiota, resulting in a reduced risk of enteric disease [3].
Thymus vulgaris has been known as a strong growth stimulant and as a good alternative for chemical materials in poultry industry across the world [4]. Thymol is the main constituent of thyme's volatile oils which form 20-55% of its extract. The major derived components of thyme plant are thymol and carvacrol, the phenolic compounds which have shown antioxidant [5] and antibacterial activities [6]. These compounds exhibit beneficial effects in poultry health and production [7]. This herb has been paid more attention due to its anticoccidial [8] and antifungal properties [9]. The volatile oils from thyme were assessed as inhibitors of microbial growth [10]. Cross *et al*. [11] studied the effects of thyme essential oils (1 g/kg) on broiler growth, digestibility, and intestinal microflora and showed that dietary thyme oil had the most positive effects on broiler performance. Cao *et al.* [12] found that mixing thyme essential oil in broiler diet provided significant benefits in terms of nutrient utilization. Keeping these facts in view the present study has been planned to study the effect of thyme essential oil on the production performance and economics of broiler production.

Materials and Methods
Two hundred forty day old straight run broiler chicks of "*Vencobb*" strain were purchased from private hatchery. The experiment was conducted for the period of six weeks. The chicks were equally and randomly distributed in to four treatment groups. Each treatment groups were further divided in to three replicates with twenty chicks in each. The dietary treatment groups were the Control diet without Thyme essential oil (A), Broiler ration containing Thyme essential oil, 100 mg/kg diet (B), Broiler ration containing Thyme essential oil, 200% mg/kg diet (C). Broiler ration containing Thyme essential oil, 300 mg/kg diet (D).

The chicks were reared on deep litter system in pens up to 6 weeks of age. The feed was provided as per treatment and water was provided *ad-lib* to all the treatment groups throughout the experimental period. The broiler pre starter feed was provided up to seven days, later on broiler starter and broiler finisher feed were provided from second to third and fourth to six weeks of age, respectively. Uniform managemental practices were provided throughout the experimental period i.e. up to six weeks of age for all the treatments groups. Birds from each group were weighed individually on day 0 and at weekly intervals. Mean live body weight gain (g/ b) was computed on weekly basis. Measured quantity of feed was offered every day and the left over feed was recorded. The difference between the feed offered and balanced feed was worked out to know the actual feed consumed by each group during each week. The feed consumption was calculated and expressed as g/b/d. On the basis of weekly live weights and weekly feed consumption, the values of FCR of each group were calculated. The feed cost per kg body weight gain in broilers reared under different treatment regimen of the present study was calculated based on feed consumption during the 0-42 day's period. The data obtained on various parameters studied during this experimental trial were subjected to statistical analysis as described by Snedecor and Cochran [13].

Results and Discussion

Growth performance

The weekly body weights of the birds in various treatment groups and the weekly cumulative gains in body weights have been presented in Table 2 and 3, respectively. There was significant ($P<0.05$) difference in weekly body weights (g) of the birds of different treatment groups at 5th and 6th weeks of age (Table 2). The highest body weight was recorded in group T1 at 6th week (2721.45±15.12), followed by group T2 (2628.20 ± 28.73), T3 (2604.60±62.56), and T0 (2480.31± 20.42) groups. The 6th week body weight in T1 group was significantly higher than control but did not differ from T2 and T3 groups. The improvement in T1 group (100 mg/kg, Thyme) over T_0 (control) was 9.71 percent. The present finding is attributed with the Al-Kassie [14] who reported that the chicks fed with 200 ppm essential oil derived from thyme had significantly higher body weight gain**.** However, Fotea *et al.* [15] found 13% higher body weight at end of experiment in thyme essential oil containing diet compared to control birds. Feizi *et al*. [16] Observed higher body weight by addition of twenty percent extract of *Thymus vulgaris* at a dose of 200cc/1000 liter, 12 hours a day, administrated a drinking water since 10 days old till slaughter. Similar finding was observed by Saki *et al.* [17] who included dietary thyme through drinking water at the level of 0.2 ml/liter.

The increase body weight and weight gain in thyme essential oil supplemented groups which may be due to active principles thymol and carvacrol present in this plant which are considered as digestion stimulating factors, in addition to their antimicrobial activity against bacteria found in the intestine [18, 16]. Langhout [19] reported that the thyme oil added in the diet increases digestive enzymes and improve nutrient utilization through the enhanced liver function [20].

Cumulative feed consumption and feed efficiency

The cumulative feed consumption and feed efficiency at different weekly intervals have been presented in Table 2 and Table 3, respectively. The non significant difference for cumulative feed consumption was observed among the treatment groups. However, numerical higher feed consumption was observed in Group B followed by C, D and the lowest feed consumption was observed in group A. The comparable feed efficiency was noted in thyme essential oil supplemented groups and control group. However, improved feed efficiency was noted in group B (Thyme EO, 100 mg/kg diet) than other treatment groups. These results are agreement with the Feizi *et al.* [16] who found non significant feed consumption and feed efficiency when thyme oil was supplemented at the dose of 0.2g/kg diet. Similarly, Jang *et al.* [21] found no significant differences in feed consumption and FCR in broilers fed a commercial feed having thymol.

The improved feed consumption and feed efficiency might be due to increased palatability of feed and also, thyme contains thymol and carvacrol principle active molecules which help to enhance the nutrient utilization by the birds [20]. Thyme extracts affect broiler's digestive tract especially intestine and causes to secret digestive enzymes and endogen. Thyme extract increases the production of amylase and chymotrypsin, as a result, the absorption rate of intestine increases and consequently the feed utilization well also increase resulting in to improved FCR [22].

Livability

The higher livability was observed in all essential oil supplemented group i.e. 96.67% and lower livability was found in group A i.e. 95%. The higher livability in diet supplemented with thyme essential oil might be due to the presence of thymol and carvacrol, which might have enhanced the immune status of these birds.

Economics

The net profit per kg live weight were Rs. 9.94, 13.30, 11.22 and 10.71 for the treatment group A, B, C and D, respectively. Comparatively higher profit per kg of live weight was observed in group B (fed Thyme essential oil, 100 mg/kg diet, Rs. 13.30) followed by group C (Thyme essential oil, 200mg/kg diet as Rs. 11.22), group D (Thyme essential oil, 300mg/kg diet, Rs. 10.71), and lower in control group A i.e. Rs. 9.94.

Table 1: Ingredient (%) and nutrient composition of experimental diets

Sr. No.	Ingredient	Prestarter	Starter	Finisher
	Maize	51.91	52.81	57.75
2	Soybean meal	40.35	38.00	32.50
3	LSP	1.00	1.2	1
4	DCP	2.00	2.0	2
5	Oil	3.60	4.80	5.5
6	DL-Methionine	0.24	0.2	0.2
7	L-Lysine	0.07	0.2	0.3
8	Salt	0.41	0.5	0.06
9	Vit. Premix*	0.02	0.02	0.02
10	Trace Minerals*	0.15	0.02	0.02
11	Toxin Binder	0.05	0.05	0.05
12	Coccidiostat	0.05	0.05	0.05
13	Choline Chloride	0.05	0.15	0.15
	Total	100	100	100
Nutrient (%)				
1	C.P.	23.00	22.0	20.00
2	ME Kcal/Kg	3032	3109	3209
5	Lysine	1.31	1.23	1.11
6	Methionine	0.50	0.54	0.51
7	Calcium	0.98	1.03	0.97
8	T.Phosphorus	0.74	0.72	0.70
9	A. Phosphorus	0.48	0.47	0.45

*Trace Mineral Mixture: - Each kg contains: Copper-15g, Iodine-2g, Iron-90g, Manganese-100g, Selenium-0.3g and Zinc-80g, **Vitamin Premix: - Each 500g contains: Vit. A12.50MIU, Vit. D3-2.50 MIU, Vit. E-12g, Vit. K-1.50g, Thiamine (B1)-1.50g, Riboflavin (B2)-5g, Pyridoxine (B6)-2g, Cyanocobalamin (B12)- 0.015g, Niacin-15g, Cal D Pantothenate-10g and Folic acid-0.50g.

Table 2: Weekly live body weight (g/b) of broilers fed Thyme essential oils

Treat. groups	Age (weeks)						
	Day-old	1st	2nd	3rd	4th	5th	6th
A T0	48.33±0.10	150.66±1.52	375.65±4.41	786.43±3.92	1403.73 ±14.98	1978.26^{c}±17.13	2480.31^{b}±20.42
BT1	48.66±0.08	149.98±2.35	383.43±5.65	814.18±5.19	1494.08±8.36	2206.48^{a}±4.75	2721.45^{a}±15.12
CT2	44.33±0.59	150.90±1.93	376.93±9.11	799.95±10.20	1461.18±29.99	2181.05^{a}±22.96	2628.20^{a}± 28.73
DT3	47.33±0.43	151.33±1.39	378.93±2.19	800.85±17.08	1449.65±10.96	2085.23^{b}±13.05	2604.60^{ab}±62.56
CD*	NS	NS	NS	NS	NS	83.708	125.891
CV %	9.468	2.598	3.565	3.226	2.479	2.104	2.563

Means bearing different superscripts differ significantly within a column. *P<0.05.

Table 3: Cumulative weekly weight gain (g/b) of broilers fed Thyme essential oil

Treatment groups	Age (weeks)					
	1st	2nd	3rd	4th	5th	6th
A	101.33±2.47	326.31±4.70	737.10±20.58	1354.40±6.66	1928.93^{b}±30.88	2430.98^{b}±26.57
B	100.15±3.01	333.60±10.78	778.43±8.12	1444.25±26.38	2120.01^{a}±51.08	2671.61^{a}±21.87
C	103.38±2.22	329.41±9.47	766.56±19.11	1413.66±30.56	2060.15^{a}±20.22	2580.68^{a}±29.30
D	103.26±1.50	330.86±1.76	752.78±17.16	1401.58±11.21	2037.16^{a}±13.16	2556.53^{ab}±62.54
CD*	NS	NS	NS	NS	104.980	125.821
CV %	4.012	3.988	3.870	2.618	2.738	2.610

Means bearing different superscripts differ significantly within a column. *P<0.05.

Table 4: Cumulative weekly feed consumption (g/b) of broilers fed Thyme essential oils

Treatment groups	Age (weeks)					
	1st	2nd	3rd	4th	5th	6th
A	133.75 ±3.76	459.41 ±7.22	1082.82 ±25.50	2058.52 ±30.21	3032.25 ±43.83	4029.57±44.63
B	130.44 ±1.82	463.10 ±5.78	1097.14 ±22.47	2134.84 ±61.35	3153.21 ±36.69	4212.95 ±13.46
C	134.70 ±2.37	460.70 ±4.97	1087.03 ±33.53	2117.37 ±24.14	3118.70 ±15.95	4159.80 ±45.67
D	135.35 ±2.39	463.01 ±4.57	1059.68 ±29.96	2092.68 ±33.39	3082.40 ±56.17	4112.44 ±50.39
CD	NS	NS	NS	NS	NS	NS
CV %	3.479	2.148	4.513	3.291	2.285	1.719

Means bearing different superscripts differ significantly within a column. *P<0.05.

Table 5: Cumulative weekly feed conversion ratio of broilers fed Thyme essential oils

Treatment groups	Age (weeks)					
	1st	2nd	3rd	4th	5th	6th
A	1.32±0.04	1.40±0.01	1.46±0.01	1.52±0.02	1.57±0.01	1.65±0.01
B	1.30±0.02	1.39±0.04	1.41±0.04	1.47±0.02	1.48±0.02	1.57±0.01
C	1.30±0.01	1.40±0.03	1.41±0.02	1.50±0.05	1.51±0.02	1.61±0.03
D	1.31±0.02	1.40±0.02	1.40±0.05	1.49±0.03	1.51±0.03	1.61±0.04
CD	NS	NS	NS	NS	NS	NS
CV %	3.042	3.101	4.266	3.456	2.434	2.685

Means bearing different superscripts differ significantly within a column. *P<0.05.

Conclusions

In conclusion, the feed supplemented with thyme essential oil at 100mg/kg resulted in significantly higher body weight gain, improved feed conversion ratio, livability and profit in broiler production.

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