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RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

Effect of supplementing different levels of ginger, thyme and their mixture on broiler performance, carcass characteristics and bacterial count

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Abstract

This study was conducted to find the effect of inclusion of ginger (*Zingnber officinale*) and thyme (*Thymus vulgaris*) and their mixture on broiler performance, carcass characteristic and bacterial count. One hundred and sixty eight one day old broiler (Ross 308) chickens were allocated randomly to seven dietary treatments from 0–42 day of age with two replicates (12 birds/pen). The experimental diets were: control (T1), 0.25% ginger powder (T2), 0.5% ginger powder (T3), 0.25% thyme powder (T4), 0.5% thyme powder (T5), 0.25% ginger + 0.25% thyme (T6) and 0.5% ginger + 0.5% thyme powder (T7). Result showed that birds consuming 0.25% ginger and 0.25% thyme had significantly higher body weight and average weight gain at day 14 of the experiment compared to the control. Similarly, body weight measured at 42 day of the experiment was significantly higher in group fed 0.25 and 0.5% thyme powder. Birds consumed 0.5% thyme powder had significantly higher feed intake during 0-14 days, however, during the whole experiment (0-42 days), the mixture of 0.25% ginger + 0.25% thyme and 0.5% ginger + 0.5% thyme powder caused significantly higher feed intake. Overall 0.25% ginger + 0.25% thyme fed birds expressed the best FCR at the end of the experimental period of 42 days. Dietary supplementation of ginger, thyme and their mixture have a significant (P>0.05) increase in Lactobacillus count compared with the control group. The results indicated that the use of thyme and ginger improved the performance and beneficial bacteria of the gut.

Keywords: Ginger; thyme; their mixture; broiler performance; lactobacillus

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Introduction

Herbal remedies are used worldwide to alleviate or treat illness and promote overall wellness. Estimated 60% of world's and 40% of the American use herbal remedies (Astin, 1998). Spice and herbs and their constituents are generally recognized to be safe and being a rich source of secondary bimolecular which exhibit significant pharmacological effect (Craig, 1999). Active principles of the plant are present in certain parts of the plant (Zhang et al., 2009). Spices and herbs can have many benefits for the health of broiler and functions such as anti-oxidation ability (Hui, 1996), antimicrobial (Dorman and Dean, 2000), enhance digestion by stimulating endogenous enzyme (Habibollah et al., 2013).

Ginger (*Zingnber officinal)* is widely used as a food spice and herbal remedy (Chrubasik et al., 2005). It has been reported to possess pharmacological chemicals for the benefits of poultry (Akhtar et al., 1984). The active compounds in ginger are gingerol, gingerdiol and gingerdion have the ability to stimulate digestive enzymes in broiler (Ali et al., 2008; Dieumou et al., 2009).

Thyme (*Thymus vulgaris*) is a member of Lamiaceae family with main components of thymol (40%) and carvacrol (15%) (Mikaili et al., 2010). This herb is used traditionally for several medicinal purposes which include antibacterial, antiseptics and correction of respiratory disease (Demir et al., 2008). Thyme is also used to stimulate saliva production (Jellin et al., 2000; Barnes et al., 2002). The active compound in

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thymol has been reported to possess antioxidant, antibacterial and antifungal properties (Hagmuller et al., 2006).

The objective of the present study was to examine either alone or the combination of ginger and thyme powder on broiler performance, carcass cuts and microbial count.

Materials and Methods

This study was conducted at the Poultry Farms, Animal Resources Department, College of Agriculture, University of Baghdad to study the effect of inclusion of different levels of ginger (*Zingnber officinale*) and thyme (*Thymus vulgaris*) powder and their mixture on broiler performance, carcass characteristic and bacterial count. One hindered and eighty sixty one-day old broiler (Ross 308) chickens were allocated randomly utilizing a complete randomize design (CRD) with seven dietary treatments from 0-42 days of age, with two replicates (12 birds/pen). The experimental diets were as follow: control (T1), 0.25% ginger powder (T2), 0.5% ginger powder (T3), 0.25% thyme powder (T4), 0.5% thyme powder (T5), 0.25% ginger + 0.25% thyme (T6) and 0.5% ginger + 0.5% thyme powder (T7). The experimental diets were formulated to be isocaloric and isonitrogenous according to NRC (1994). The diets were prepared freshly each week from 0–28 days (starter) and from 29–42 days of age. The ingredient and chemical composition of the diets is presented in Table 1. Feed and water were provided *ad libitum*. Birds were vaccinated against Newcastle and Gumboro diseases according to their schedule.

Table 1: Ingredients and chemical composition of the experimental diets

Ingredients (%)	Starter 0 – 28 days	Grower 29 – 42 days
Yellow corn	39	45
Wheat	28	22
Soybean meal (48%)	25	24
Protein con. (40%)	5	5
Sun flower oil	1	2
Dicalcium phosphate	1	1
Minerals and vitamin mixture*	1	1
Chemical composition		
Crude Protein (%)	21.94	20.07
Metabolized energy (kcal/kg)	2921.9	3038.2
Calcium (%)	0.84	0.84
Available phosphorus (%)	0.42	0.42
Lysine (%)	1.20	1.02
Meth. +Cys. (%)	0.82	0.78

*Provided per kg of diet: Vitamin A: 22000 IU; D3: 60; E: 60 mg; B1: 60 mg; B2: 140 mg; B6: 80; B12: 700 mcg; Biotin: 2.00 mcg; Folic acid: 20 mg; Vitamin K3: 5 mg; Pantothenic acid: 320 mg; Niacin: 60 mg; Choline chloride: 7.5 mg; Cu: 200 mg; Mn: 1.6 mg; Zn: 1.2 mg; Fe: 1.0 mg; I: 20 mg; Se: 5 mg; Calculated composition of experimental diets according to NRC (1994).

The birds were kept in floor pens (1.2 x 1.2 m) in an open sided house. Live body weight, weight gain, feed intake and feed conversion ratio were measured at 14, 28 and 42 days of age. Mortality was recorded throughout the period of the study as occurred. At the end of the experiment, two birds whose body weights were close to the group average was selected from each replicate (4birds/treatment). Selected birds were leg banded (weight and slaughter) for carcass evaluation. Pre-slaughter weight and dressing weight was obtained to calculate dressing percentage and carcass cut for each birds. Bursa of Fabricious and spleen relative weights were calculated by dividing organ weight by live body weight and multiplied by 100.

One gram of Jejunum contents was weighed and transferred into test tube containing 9 ml of 0.1% peptone solution. The samples were mixed well and serial dilutions were prepared for Lactobacillus and *E. coli* count (Atlals et al., 1995).

Data were subjected to analysis of variance (SAS, 2002) and significant means were separated by Duncan's multiple range test (Duncan, 1955).

Results

The effect of supplementing different levels of ginger and thyme powder and their mixture on live body weight is presented in Table 2. The data revealed that birds consuming 0.25% ginger and 0.25% thyme had significantly higher body weight at day 14 of the experiment compared to the control. Similarly, body weight measured at 42 day of the experiment was significantly higher in group fed 0.25 and 0.5% thyme powder.

The data in Table 3 showed that birds consuming 0.25% ginger + 0.25% thyme had a significantly high average weight gain after 14 days of the experiment. At the end of the experiment (29-42 days), birds fed 0.25% ginger powder showed significantly higher weight gain.

The effect of different dietary supplementation of ginger and thyme powder and their mixture on feed intake is presented in Table 4. Birds consumed 0.5% thyme powder had significantly higher feed intake during 0-14 days, however, during the whole experiment (0-42 days), the mixture of 0.25% ginger + 0.25% thyme and 0.5% ginger + 0.5% thyme powder caused significantly higher feed intake.

The mean FCR of the birds fed ginger and thyme or their combination is shown in Table 5. The result revealed that 0.5% ginger + 0.5% thyme powder showed better FCR during the period of 14-28 days, however, the same group showed the worst FCR during 29-42 days. Overall 0.25% ginger + 0.25% thyme fed birds expressed the best FCR at the end of the experimental period of 42 days.

Table 2: Effect of ginger, thyme powder and their mixture on live body weight (g) of broiler chickens

Age (days)	Cont. T1	Ginger, thyme powder and their mixture (%) T2	T3	T4	T5	T6	T7
0-14	337.71± 13.20^{ab}	339.30 ± 10.70^{ab}	330.50 ± 18.50^{ab}	358.14± 15.36^{ab}	313.13 ± 3.69 ^{b}	394.65± 10.53 ^{a}	351.00± 3.00^{ab}
14-28	1315.7± 15.68	1207.4 ± 8.0	1259.1± 11.41	1271.0± 9.00	1236.4± 13.63	1330.00 ± 12.24	1215.00± 6.24
0-42	2180.73± 15.18^{c}	2420.98 ± 14.47^{a}	2373.64 ± 13.27^{ab}	2424.39± 10.88^{a}	2424.73± 9.72^{a}	2360.07± 15.56^{ab}	2380.00± 7.00^{ab}

$^{a, b}$ Mean in the same raw with different superscripts are significantly (P<0.05) different, T1 = Control; T2 = 0.25% ginger powder; T3 = 0.5% ginger powder; T4 = 0.25% thyme powder; T5 = 0.5% thyme powder T6 = 0.25% ginger + 0.25% thyme; T7 = 0.5% ginger + 0.5% thyme powder

Table 3: Effect of ginger, thyme powder and their mixture on average gain (g) of broiler chickens

Age (days)	Cont. T1	Ginger, thyme powder and their mixture (%) T2	T3	T4	T5	T6	T7
0-14	296.71± 13.20^{ab}	298.25 ± 10.75^{ab}	289.55± 8.54^{ab}	317.14 ± 4.30^{ab}	272.13 ± 3.69^{b}	353.65± 3.53^{a}	310.00± 3.00^{ab}
14-28	978.00 ±14.0	868.20 ±7.25	928.6 ±9.19	912.9 ±3.63	923.2 ±11.32	935.4 ±8.71	884.50 ±5.75
28-42	865.03 ±10.5^{c}	1213.53 ±3.53^{a}	1114.5 ±8.68^{ab}	1153.39 ±6.11^{ab}	1188.41 ±5.40^{ab}	1030.04 ±1.32^{b}	1145.03 ±5.24^{ab}

$^{a, b, c}$Mean in the same raw with different superscripts are significantly (P<0.05) different, T1 = Control; T2 = 0.25% ginger powder ; T3 = 0.5% ginger powder; T4 = 0.25% thyme powder ; T5 = 0.5% thyme powder T6 = 0.25% ginger + 0.25% thyme; T7 = 0.5% ginger + 0.5% thyme powder

Table 4: Effect of ginger, thyme powder and their mixture on feed intake (g) of broiler chickens

Age (days)	Cont. T1	Ginger, thyme and their mixture (%) T2	T3	T4	T5	T6	T7
0-14	445.91± 5.45^{bcd}	493.41 ± 15.68^{ab}	516.86 ± 9.14^{a}	437.91 ± 5.09^{d}	520.96± 19.95^{a}	482.18 ± 5.82^{abc}	444.55 ± 7.72^{cd}
14-28	1293.4 ± 9.40	1293.9 ± 9.32	1329.0 ± 36.95	1292.4 ± 14.88	1361.2± 44.22	1203.2 ±50.91	1193.4 ± 58.86
28-42	1984.1 ± 3.9	1918.7 ± 14.98	1972.1 ± 40.86	1979.8 ± 45.25	2004.7± 19.72	1914.0 ±30.45	1863.6 ± 21.36
0-42	3733.4 ± 17.95^{b}	3706.0 ± 58.58^{b}	3818.0 ± 17.05^{b}	3710.02 ± 55.04^{b}	3886.9 ± 54.90^{b}	3599.4 ± 45.31^{a}	3501.6 ± 45.22^{a}

$^{a-d}$ Mean in the same raw with different superscripts are significantly (P<0.05) different; T1 = Control; T2 = 0.25% ginger powder; T3 = 0.5% ginger powder; T4 = 0.25% thyme powder ; T5 = 0.5% thyme powder T6 = 0.25% ginger + 0.25% thyme ; T7 = 0.5% ginger + 0.5% thyme powder

Table 5: Effect of ginger, thyme powder and their mixture on feed conversion ratio of broiler chickens

Age (days)	Cont. T1	Ginger, thyme and their mixture (%) T2	T3	T4	T5	T6	T7
0-14	1.52±0.03	1.71±0.16	1.66±0.26	1.60±0.04	1.47±0.04	1.55±0.00	1.50±0.04
14-28	1.49±0.01^{a}	1.39±0.05^{ab}	1.45±0.03^{ab}	1.40±0.04^{ab}	1.45±0.03^{ab}	1.37±0.10^{ab}	1.23±0.12^{b}
28-42	1.63±0.03^{b}	1.72±0.03^{b}	1.70±0.00^{b}	1.66±0.03^{b}	1.94±0.18^{ab}	1.64±0.10^{b}	2.16±0.10^{a}
0-42	1.56±0.00^{ab}	1.58±0.00^{ab}	1.60±0.02^{ab}	1.55±0.00^{ab}	1.67±0.07^{a}	1.52±0.00^{b}	1.62±0.05^{ab}

$^{a, b}$ Mean in the same raw with different superscripts are significantly (P<0.05) different , N.S-No significant; T1 = Control; T2 = 0.25% ginger powder; T3 = 0.5% ginger powder; T4 = 0.25% thyme powder; T5 = 0.5% thyme powder T6 = 0.25%ginger + 0.25% thyme; T7 = 0.5%ginger + 0.5% thyme powder

Table 6: Effect of ginger, thyme powder and their mixture on dressing percentage, carcass cuts percentage and fat-pad percentage

Treatment	T1	T2	T3	T4	T5	T6	T7
Dressing percentage	73.77±1.98	72.47±2.47	73.27±0.46	75.40±0.07	74.42±1.59	74.82±1.53	75.10±1.51
Breast (%)	37.71±1.35	36.89±1.62	37.56±1.90	40.11±1.13	38.07±2.20	37.88 ±1.28	37.96±3.68
Legs (%)	28.18± 1.69	28.59±0.27	27.94 ±0.05	27.33 ±0.33	27.92 ±2.01	28.42 ±1.03	29.10 ±2.31
Wing (%)	10.8 ±1.22	10.63 ±0.15	10.37 ±0.29	10.23 ±0.48	10.43 ±0.29	10.29 ±0.71	10.83 ±0.04
Back (%)	16.56± 2.41	16.66±0.37	16.51 ±0.49	15.41 ±0.66	16.49 ±0.68	16.26 ±0.10	14.80 ±0.75
Neck (%)	5.91±0.28	5.75 ±0.37	5.85 ±0.81	5.22 ±0.72	5.35 ±0.57	5.40 ±0.35	5.66 ±0.36
Abdominal fat %	0.73±0.19	0.89 ±0.72	1.04 ±0.05	1.09 ±0.23	1.70 ±0.02	1.70 ±0.32	1.01 ±0.33

T1 = Control; T2 = 0.25% ginger powder; T3 = 0.5% ginger powder; T4 = 0.25% thyme powder; T5 = 0.5% thyme powder T6 = 0.25% ginger + 0.25% thyme; T7 = 0.5% ginger + 0.5% thyme powder

Table 7: Effect of ginger, thyme powder and their mixture on percentage of visceral organs at 42 days of age

Treatments	Liver	Heart	Gizzard
T1	3.10±0.33	0.69±0.03	2.21±0.25
T2	2.86±0.09	0.66±0.02	2.05±0.07
T3	2.80±0.22	0.80±0.21	2.34±0.09
T4	2.66±0.06	0.56±0.01	2.25±0.26
T5	2.98±0.33	0.64±0.09	2.17±0.24
T6	3.21±0.13	0.67±0.06	2.12±0.11
T7	2.88±0.45	0.69±0.11	2.27±0.40
	N.S	N.S	N.S

Significant.T1 = Control; T2 = 0.25% ginger powder; T3 = 0.5% ginger powder; T4 = 0.25% thyme powder; T5 = 0.5% thyme powder T6 = 0.25%ginger + 0.25%thyme; T7 = 0.5% ginger + 0.5% thyme powder

Table 8: Effect of ginger, thyme powder and their mixture on relative weight of Bursa of Fabricious and spleen index of broiler chickens at the end of the experiment

Parameter	T1	T2	T3	T4	T5	T6	T7
Bursa of Fabricious	0.12±0.01^{b}	0.14 ±0.03^{a}	0.14 ±0.00^{a}	0.12 ±0.01^{b}	0.16 ±0.04^{a}	0.15 ±0.00^{a}	0.14 ±0.03^{a}
Spleen index	0.17±0.03^{b}	0.23 ±0.08^{a}	0.18 ±0.01^{b}	0.25±0.04^{a}	0.16 ±0.02^{b}	0.16 ±0.00^{b}	0.15 ±0.04^{b}

$^{a, b}$Mean in the same raw with different superscripts are significantly (P<0.05) different; T1 = Control; T2 = 0.25% ginger powder; T3 = 0.5% ginger powder; T4 = 0.25% thyme powder; T5 = 0.5% thyme powder T6 = 0.25% ginger + 0.25% thyme; T7 = 0.5% ginger + 0.5% thyme powder

Table 9: Effect of supplementing ginger, thyme powder and their mixture on logarithmic count of lactobacillus and *E. coli* (Log CFU/g) in jejunum of broiler chickens at the end of the experiment

Treatments	Lactobacillus	*E. coli*
T1	14.81d	15.42
T2	17.03a	14.60
T3	16.58ab	12.37
T4	16.78a	14.91
T5	15.83bc	10.04
T6	15.04dc	14.47
T7	17.09a	14.76

$^{a, b, c}$ Mean in the same column with different superscripts are significantly (P<0.05) different significant. T1 = Control; T2 = 0.25% ginger powder; T3 = 0.5% ginger powder; T4 = 0.25% thyme powder; T5 = 0.5% thyme powder T6 = 0.25% ginger + 0.25% thyme; T7 = 0.5% ginger + 0.5% thyme powder

Table 6 represents the effect of different levels of ginger and thyme powder and their mixture on dressing percentage without giblet and carcass cut percentage of different groups. There were no significant difference between treatments in dressing percentage without giblet, carcass cuts and abdominal fat percentage.

The effect of different levels of ginger and thyme powder and their mixture on visceral organs percentage is presented in Table 7. No significant difference was found between these parameters in the treated and control groups.

Table 8 indicates the effect of ginger, thyme and their mixture on Bursa of Fabricious and spleen index of broiler chickens at 42 days of age. Bursa of fabricious increased significantly in treated groups except the treatment of 0.25% ginger powder. Similarly, the spleen index increased significantly in group fed 0.25% ginger powder and 0.25% thyme powder.

The effect of dietary treatments on logarithmic count of Lactobacillus and *E. coli* in jejunum of broiler chickens at 42 days of age presented in Table 9. Dietary supplementation of ginger, thyme and their mixture have a significant (P>0.05) increase in Lactobacillus count compared with the control group. Highest Lactobacillus count was obtained in T2, T4 and T7 as compare with other treatments. The result showed that there was no significant (P>0.05) difference in *E. coli* count between different treatments, however, *E. coli* count was numerically lower in all treated groups compared to the control.

Discussion

In this study, supplementation of ginger and thyme powder alone or in combination up to 0.5% have resulted in a positive effect on body weight, weight gain, feed intake and Lactobacillus count compared to the control group. These results are in agreement with Tekeli et al. (2011) who stated that ginger supplementation stimulate lactic acid bacteria and decreases pathogen bacteria and result in increasing in nutrient absorption and stimulating growth of birds (Dieumou et al., 2009; Ahmed, 2013; Zomrawii et al., 2013). The positive effect of ginger and thyme powder on live weight, weight gain and feed intake may be related to active compound such as gingerol, gingerdiol and gingerdione in ginger powder and thymol and carvacrol in thyme powder, which have digestive stimulating effects (Jellin et al., 2000; Barnes et al., 2002; Ali et al., 2008; Dieumou et al., 2009). Besides gingerol, gingerdiol, gingerdione and carvacrol destroy pathogen microorganism in the digestive system

increasing digestive enzyme and enhancing liver function which resulted in improvement in birds performance (Dorman and Dean, 2000; Al-Mashhadani, 2012).

In the present study, no significant effect of the treatments was found on dressing percentage and cut carcass percentages. These results are in agreement with El-Deek et al. (2002), Moorthy et al. (2009), Najafi and Torki (2010), Rahimi et al. (2011) who did not report any significant differences in dressing percentage and carcass cuts when they supplemented ginger or thyme in feed or drinking water of broiler chickens. These results are in partial agreement with Toghyani et al. (2010) and Sadeghi et al. (2011) in the reported values of bursa of fabricious index. The result revealed that there was no significant difference between different groups in the percentage of liver, heart and gizzard. These results are in agreement with Najafi and Torki (2010) and Sadeghi et al. (2011).

The beneficial effects of thyme on bacterial and fungal activities have been reported by some researcher (Abdulkarimi, 2011; Feizi and Nazeri, 2011). Our findings are in agreement with Al-Kassie (2010) who found that supplementing thyme powder (0.5% and 1% thyme) resulted in decreased bacterial count in jejunum of broiler chickens.

It can be concluded from this study that inclusion of dietary broiler with ginger or thyme up to 0.5% of the diet improve body weight, weight gain and feed consumption. Further, the result indicated that ginger and thyme powder improved bacterial count at the level tested in this study.

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