

REGULAR ARTICLE

Effect of dietary garlic and thyme seed supplementation on the production performance, carcass yield and gut microbial population of broiler chickens

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Abstract

A total of 200 Cobb 500 male broilers were randomly allocated to 4 treatments consisting of 5 replications with 10 chicks each in order to evaluate the effect of dietary garlic and thyme seed supplementation on the production performance, carcass yield and gut microbial population. Treatments were control diet (T1), control diet with 1% thyme seed powder (T2), control diet with 1% garlic powder (T3) and control diet with 0.5% thyme seed and 0.5% garlic powder (T4). Feed intake, body weight, weight gain, feed conversion ratio (FCR), carcass yield was not significantly ($p > 0.05$) improved by dietary treatments compared to control. *Escherichia coli* (*E. coli*) count in the gut of broilers did not show significant difference among dietary treatments. However, *Lactobacilli* count in the gut of broilers significantly ($p < 0.05$) increased in T2 compared to that of T1. *Lactobacilli* count in the gut of broilers received T1, T3 and T4 did not differ significantly ($p > 0.05$) with each other. It was concluded that thyme seed was reliable as feed additive in the broiler diet and could provide positive advantages to the colonization and proliferation of *Lactobacilli*.

Key words: Thyme seed, garlic, performance, gut microbial population

Introduction

Antimicrobial agents are important in treating infections and to improve production and feed efficiency in field grown animals and poultry since 1950 (Anderson *et al.*, 2003). The concerns about possible antibiotic resistance have aroused great caution in the usage of antibiotic in the animal husbandry (Rahimi *et al.*, 2011). There are several alternatives to antibiotics as growth stimulators which are prebiotics, and medicinal plants or parts of plants (Simon, 2005).

In poultry nutrition, garlic (*Allium sativum*)

has profound effect on growth and also for stopping infections (Onibi *et al.*, 2009; Mahmood *et al.*, 2009; Ahsan *et al.*, 1996; Sarica *et al.*, 2005; Adibmoradi *et al.*, 2006; Kim *et al.*, 2009). Moreover, garlic has many medicinal properties (Cavallito *et al.*, 1994). Thyme (*Thymus vulgaris*) is one of the medicinal plants in Lamiaceae family (Ghasemi *et al.*, 2010). The usage of thyme in poultry diets (Khan *et al.*, 2012) and also has many secondary metabolites which are medicinally active (Basilico and Basilico, 1999).

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In Myanmar, the effect of dietary supplementation of garlic and thyme combination on the performance and antibacterial activity in the intestine of broiler chickens as an alternative to antibiotic growth promoter has not been investigated yet. Therefore, this experiment was aimed to evaluate the effect of dietary garlic and thyme seed supplementation on production performance, carcass yield and gut microbial population of broiler chickens.

Materials and Methods

Experimental animals and treatments

A total of 200 one-day old male broiler chicks (Cobb 500) were randomly assigned to 4 treatments, each with 5 replicates consisting of 10 chickens. The initial temperature of 33°C was gradually reduced according to the age of birds (3°C every week) until reaching 21°C and then kept constant. Vaccinations against Newcastle disease and infectious bronchitis were performed at 1st and 3rd week and also given Gamboro disease vaccine at 2nd and 4th week. Feed and water were offered *ad libitum*. Chickens were fed a starter diet from day 1 to 21 and finisher diet from day 22 to 42 (Table 1). All rations were formulated to meet the requirements of broiler chickens recommended by NRC (1994).

Table 1. Composition of experimental diets.

Ingredients	Experimental diets (%)	
	Starter (1 to 21 days)	Finisher (22 to 42 days)
Maize	52.00	60.00
Broken rice	6.00	6.00
Rice bran	7.50	7.00
Groundnut meal	12.50	9.50
Soybean meal	9.40	4.25
Fish meal	9.00	9.75
Fish oil	2.50	2.50
Oyster shell	0.50	0.40
D.C.P	0.20	0.20
Premix	0.20	0.20
Lysine	0.10	0.10
Methionine	0.10	0.10
Total	100.00	100.00
CP (%)	22.10	19.47
ME (Kcal/kg)	3113.56	3200.87
Energy protein ratio	140.86	164.42

Four dietary treatments were prepared and the basal ration (T1) was supplemented with 1% thyme seed powder (T2), 1% garlic powder (T3) and 0.5% thyme seed powder+0.5% garlic

powder (T4) respectively. Daily feed intakes were noted and body weight of each bird was recorded at the end of each week and repeated weekly up to the last day of the experiment, then weight gain and FCR were calculated on weekly basis.

Source and preparation of garlic and thyme seed

Garlic and thyme seed were purchased fresh from the local market. Fresh garlic bulbs were prepared as follows: their rinds and husks were peeled off using knife, and then the peeled garlic was sun-dried. After it is dried, it was ground to fine powder. Thyme seeds were also ground to fine powder. Thyme seed powder and dried garlic powder were stored at room temperature and added to the rations and was properly hand-mixed to ensure homogenous distribution of the powder before feeding.

Sampling and microbial enumeration

At the end of the experiment (42 days), 20 birds (one bird from each replicate) were randomly selected and slaughtered for carcass evaluation and intestinal samples. A 10-fold serial dilution method was used to determine colony forming unit (cfu) in each gram of intestinal content sample by means of pour plate method. *E. coli* was cultured on Eosin Methylene Blue (EMB) agar at 37°C for 48 hours. Lactobacilli were enumerated on de Man, Rogosa, Sharpe agar at 37°C for 72 hours. Colonies with metallic green sheen colour were considered as *E. coli* while the white colour colonies were identified as lactobacilli.

Statistical analysis

The data were subjected to ANOVA using general linear model (GLM) procedure of SAS® (SAS® Institute, 2002) as a RCBD experiment. The significant differences among treatments were determined at $p < 0.05$ by Duncan's Multiple Range Test (DMRT) (Steel and Torrie, 1980).

Results

Production performance

Supplementation of garlic and thyme seed powder either alone or in combination did not significantly ($p > 0.05$) affect the feed consumption, body weight, weight gain and FCR of broilers. Cumulative feed consumption, cumulative weight gains and cumulative FCR of broilers are shown in Table 2. There were no significant ($p > 0.05$) differences among the dietary treatments on the cumulative feed consumption, cumulative weight gains and cumulative FCR of broilers.

Table 2. Cumulative feed intake, cumulative weight gains and cumulative FCR of broilers.

	T1	T2	T3	T4	Significant Level
Cumulative feed intake	4546.12±183.15	4545.48±51.02	4672.26±191.63	4586.10±148.60	NS
Cumulative weight gain	2022.77±38.10	2095.96±53.74	2117.08±33.98	2105.55±39.01	NS
Cumulative FCR	2.24±0.05	2.17±0.04	2.20±0.06	2.18±0.06	NS

The means within the same row are not significantly different at (p>0.05) (ANOVA).

NS = Not significant, SEM = Standard error of mean

T1 = control diet

T2 = control diet with 1% thyme seed powder

T3 = control diet with 1% garlic powder

T4 = control diet with (0.5% thyme seed powder + 0.5% garlic powder)

Carcass yield

Effect of dietary garlic and thyme seed powder on the carcass yield of broilers was shown in Table 3. Dietary treatments did not induce any significant effect on the carcass yield of broilers.

Gut microbial population of broilers

Table 4 represents the effect of dietary garlic and thyme seed powder on the *E. coli* and lactobacilli count in the gut of broilers. The

result of this study showed that no significant (p>0.05) effect on the *E. coli* count in the gut of broilers was observed among dietary treatments. Lactobacilli count of broilers fed T2 was significantly (p<0.05) higher than that of broilers fed T1 but did not differ significantly (p>0.05) with that of broilers fed T3 and T4. Lactobacilli count of broilers fed T1, T3 and T4 did not differ significantly (p>0.05) with each other.

Table 3. Carcass yield of broilers.

Parameters	Parts of carcass yield (Mean±SEM)				Significant Level
	T1	T2	T3	T4	
Carcass wt (g)	2073.50±42.56	2044.25±40.92	2093.00±26.90	2070.25±3.98	NS
Wing (%)	5.66±0.43	5.39±0.59	6.21±0.84	5.97±0.60	NS
Breast (%)	20.41±0.96	20.65±0.92	21.05±1.52	22.29±1.86	NS
Back (%)	44.26±1.33	42.52±1.99	41.71±2.30	43.33±2.09	NS
Thigh (%)	10.38±0.54	11.39±0.97	10.54±0.67	12.24±0.31	NS
Drumstick (%)	11.90±0.51	12.76±0.68	11.17±0.50	11.62±0.38	NS

The means within the same row are not significantly different at (p>0.05) (ANOVA).

NS = Not significant, SEM = Standard error of mean

T1 = control diet

T2 = control diet with 1% thyme seed powder

T3 = control diet with 1% garlic powder

T4 = control diet with (0.5% thyme seed powder + 0.5% garlic powder)

Table 4. Gut microbial population of broilers.

	T1	T2	T3	T4	Significant Level
<i>E. coli</i> count	7.66±0.03	7.39±0.18	7.64±0.06	7.55±0.15	NS
Lactobacilli count	7.33±0.20 ^b	7.63±0.25 ^a	7.48±0.20 ^{ab}	7.49±0.15 ^{ab}	p<0.05

^{a,b} The means within the same row with the different superscripts are significantly different at (p<0.05) (ANOVA). NS = Not significant, SEM = Standard error of mean

T1 = control diet

T2 = control diet with 1% thyme seed powder

T3 = control diet with 1% garlic powder

T4 = control diet with (0.5% thyme seed powder + 0.5% garlic powder)

Discussion

Although it was expected that incorporating the dietary garlic and thyme seed powder either alone or in combination would stimulate the growth performance of broilers, there were no significant ($p > 0.05$) effect on the feed intake, body weight, weight gain and FCR of broilers among dietary treatments. Well-nourished healthy chicks do not positively respond and possibly lead to the diminished efficacy of dietary additives when they are housed under clean conditions and at a moderate stocking density.

The results of the present study contrasted some of these following observations. Ademola (2004) reported that birds received garlic (5g/kg, 10g/kg and 15g/kg) treatments in feed had slightly better average weight and final live weight than those of control birds. Similar finding reported by Ramiah *et al.* (2014) who found that birds fed diets supplemented garlic powder (0.5%) had higher feed intake and greater body weight than control. It might be due to the action of the compound allicin in garlic promotes the action of the intestinal flora thereby improving digestion and increasing the utilization of energy leading to improved growth of broilers (Pourali *et al.*, 2010).

El-Ghousein and Al-Betawi (2009) also observed that the addition of crushed thyme to the basal ration (0.5%, 1%, 1.5% and 2% level) increased growth performance of broilers compared with control group. Therefore, Lee *et al.* (2003) suggested that thyme enhance the digestive enzyme activities and may result in better feed utilization and nutrient availability.

In addition, supplementation of garlic and thyme leaves powder combination as feed additives at level of 1% improved productive performance of broilers (Abid, 2013). A similar observation reported by Isa (2011) who concluded that broiler's performance was improved in the group received mixture of garlic and thyme leaves in comparison with the additives given separately. This positive effect might be due to increased palatability of diets when mixture of garlic and thyme leaves was incorporated into the diets.

The results obtained in this experiment are relevant to the data from Horton *et al.* (1991). They found that garlic had no effect on body weight, feed intake or efficiency by giving 0.1g, 1g and 10g. Toghyani *et al.* (2010) also

reported that low dosage (5g/kg) of thyme powder have significant effect on broilers' body weight and feed conversion ratio, while the high dosage (10g/kg) did not show this effect.

This study was observed that no significant differences among the treatments on the carcass yield of broilers. Hosseini-Mansoub and Mohammad-Nezhady (2011) reported that incorporation of 1.5% garlic in the broiler diets reduced the abdominal fat but did not affect other carcass traits. Similarly, Habibian *et al.* (2010) reported that the abdominal fat decreased by inclusion of 20 g/kg garlic in the broiler diets but there was no effect of garlic on carcass traits.

In the present study, no significant ($p > 0.05$) differences of *E. coli* count in the gut of broilers were observed among dietary treatments. This result contrasted with the finding of Ramiah *et al.* (2014) who reported that dietary supplementation of garlic powder (0.5%) significantly reduced *E. coli* count in the gut when compared to control and lactobacilli count of chickens were significantly higher than the control group. From the data of the current study, the dietary treatments neither increased nor decreased colony forming unit of *E. coli* count in the gut of broilers in comparison with control. Therefore, it could be assumed that chickens possessed balanced intestinal condition and healthy intestinal tract due to microflora were already in an equilibrium state.

With regard to lactobacilli count, the colony forming unit of lactobacilli count in the gut of broilers fed T2 was significantly ($p < 0.05$) differed with that of broilers fed T1. This result is in line with Rahimi *et al.* (2011) who affirmed that lactobacilli count in the thyme group increased as compared with the other groups. The result of the present study advocated Tschirch (2000) who suggested that carvacrol (essential oil component) in thyme seed which has a stimulating effect on lactobacilli proliferation.

Conclusions

According to the present findings, addition of thyme seed powder seems to have a beneficial effect on the lactobacilli bacterial population in the intestine of broilers. Therefore, it could be concluded that thyme seed is reliable as feed additive in the broiler diet and could provide positive advantages proliferation of lactobacilli.

References

- Abid AR (2013). Productive performance of broilers (Ross 308) diet supplemented with thyme, garlic and combination. *J. Kerbala Uni.* **11**: 293-301.
- Ademola SG (2004). Effect of garlic supplementation on hematological parameters of broiler chicken. *Moor J. Agri. Res.* **5**: 122-128.
- Adibmoradi M, Navidshad B, Seifdavati J and Royan M (2006). Effect of dietary garlic meal on histological structure of small intestine in broiler chickens. *J. Poult. Sci.* **43**: 378-383.
- Ahsan M, Chowdhury AKA, Islam SN and Ahmed ZU (1996). Garlic extract and allicin: Broad spectrum antibacterial agents effective against multiple drug resistant strains of *Shigella dysenteriae* type 1 and *Shigella flexneri*, enterotoxigenic *Escherichia coli* and *Vibrio cholerae*. *Phytother. Res.* **10**: 329-331.
- Anderson AD, Nelson JM, Rossiter S and Angulo FJ (2003). Public health consequences of antimicrobial agents in United States. *Microbial Drug Resist.* **9**: 373-379.
- Basilico MZ and Basilico JC (1999). Inhibitory effects of some spice essential oils on *Aspergillus ochraceus* NRRL 3174 growth and ochratoxin A production. *Letters in Appl. Microbiol.* **29**: 238-241.
- Cavallito CJ, Buck JS and Suter CM (1994). Allicin, the antibacterial principle of *Allium sativum*. Determination of the chemical composition. *J. Am. Chem. Society.* **60**: 1952-1958.
- El-Ghousein SS and Al-Beitawi NA (2009). The effect of feeding of crushed thyme (*Thymus vulgaris*) on growth, blood constituents, gastrointestinal tract and carcass characteristics of broiler chickens. *J. Poult. Sci.* **46**: 100-104.
- Ghasemi R, Zarei M and Torki M (2010). Adding medicinal herbs in including garlic (*Allium sativum*) and thyme (*Thymus vulgaris*) to diet of laying hens and evaluating productive performance and egg quality characteristics. *Am. J. Anim. Vet. Sci.* **5**: 151-154.
- Habibian DS, Zamani MA, Maghsoudi N, Aali E, Gerami R and Dehsadeghi E (2010). The effects of fresh garlic on the serum concentration of total cholesterol, total triglyceride and adipose tissues of broilers. *Biochim. Biophys. Acta.* **19**: 363-365.
- Horton GMJ, Fennell MJ and Prasad BM (1991). Effect of dietary garlic (*Allium sativum*) on performance, carcass composition and blood chemistry changes in broiler chickens. *Can. J. Anim. Sci.* **71**: 939-942.
- Hosseini-Mansoub N and Mohammad-Nezhady MA (2011). The effect of using thyme, garlic and nettle on performance, carcass quality and blood parameters. *Ann. Biol. Res.* **2**: 315-320.
- Isa KJJ (2011). Performance and lipid profile of broilers fed two medicinal plants. MSc Thesis. Faculty of Graduate Studies, An-Najah National University, Nablus, Palestine.
- Khan RU, Naz S, Nikousefat Z, Tufarelli V and Laudadio V (2012). *Thymus vulgaris*: alternative to antibiotics in poultry feed. *World's Poult. Sci. Association.* **68**: 401-408.
- Kim YJ, Jin SK and Yang HS (2009). Effect of dietary garlic bulb and husk on the physicochemical properties of chicken meat. *Poult. Sci.* **88**: 398-405.
- Lee KW, Everts H, Kappert HJ, Frehner M, Losa R and Beynen AC (2003). Effects of dietary essential oil components on growth performance, digestive enzymes and lipid metabolism in female broiler chickens. *Brit. Poult. Sci.* **44**: 450-457.
- Mahmood S, Mushtaq-Ul-Hassan M, Alam M and Ahmad F (2009). Comparative efficacy of *Nigella sativa* and *Allium sativum* as growth promoters in broilers. *Int. J. Agri. Biol.* **11**: 775-778.
- National Research Council (NRC) (1994). Nutrients Requirements of Poultry, 9th ed. National Academy Press, Washington D.C.
- Onibi GE, Adebisi OE, Fajemisin AN and Adetunji AV (2009). Response of broiler chickens in terms of performance and meat quality to garlic (*Allium sativum*) supplementation. *Afr. J. Agri. Res.* **4**: 511-517.
- Pourali M, Mirghelenj SA and Kermanshahi D (2010). Effect of garlic powder on productive performance and immune response of broiler chickens challenged with Newcastle disease virus. *Global Veterinaria.* **4**: 616-621.
- Rahimi S, Zadeh ZT, Torshizi MAK, Omidbaigi R and Rokni H (2011). Effect of the three

- herbal extracts on growth performance, immune system, blood factors and intestinal selected bacterial population in broiler chickens. *J. Agr. Sci. Technol.* **13**: 527-539.
- Ramiah SK, Zulkifli I and Ramiah NAA (2014). Effects of two herbal extracts and virginiamycin supplementation on growth performance, intestinal microflora population and fatty acid composition in broiler chickens. *Asian Austral. J. Anim. Sci.* **27**: 375-382.
- Sarica S, Ciftci A, Demir E, Kilinc K and Yildirim Y (2005). Use of an antibiotic growth promoter and two herbal natural feed additives with and without exogenous enzymes in wheat based broiler diets. *South Afr. J. Anim. Sci.* **35**: 61-72.
- SAS® Institute (2002). SSAT/ STAT User's Guide Release 6.03 edition. SAS® institute Inc, Cary, NC.
- Simon O (2005). Micro-organisms as feed additives-probiotics. *Adv. Pork. Prod.* **39**: 161-167.
- Steel RG and Torrie JH (1980). Principles and procedures of statistics. A biometrical approach 2nd ed. Mc Graw-Hill Book Company, New York.
- Toghyani M, Tohidi M, Gheisari AA and Tabeidian SA (2010). Performance, immunity, serum biochemical and hematological parameters in broiler chicks fed dietary thyme as alternative for an antibiotic growth promoter. *Afr. J. Biotechnol.* **9**: 6819-6825.
- Tschirch H (2000). The use of natural plant extracts as production enhancers in modern animal rearing practices. *Zeszyly Naukowe Akademicy Rolniczej Wroclaw, Zootechnik.* **115**: 25-39