



## Effect of dietary supplementation of thyme and garlic essential oils on the growth performance and carcass characteristics in commercial broilers

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### ABSTRACT

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A biological experiment was conducted to evaluate the effect of dietary supplementation of thyme and garlic essential oils individually and in combination on growth performance and carcass characteristics. Two hundred-day-old commercial broiler chicks were randomly allotted to four dietary treatments with ten replications of 5 birds each and reared in a battery brooder up to 42 d of age. Broilers were fed on corn-soy-based broiler pre-starter (1-14 d), starter (15-28 d) and finisher (29-42 d) diets. The treatment consists of a control diet supplemented with no essential oil (CD), a control diet supplemented with thyme essential oil (TEO) or garlic essential oil (GEO) @ 25 g/100 kg and thyme and garlic essential oil (TGEO) @ 50 g/100 kg. Performance parameters were recorded at weekly intervals and at the end of the experiment; the birds were slaughtered, dressed then used for assessment of carcass parameters. Dietary supplementation of essential oils was effective in improving body weight gain, feed consumption and feed conversion ratio. No significant difference was observed in carcass characteristics. Overall body weight gain (BWG) and overall feed consumption were significantly ( $P < 0.05$ ) improved in essential oil supplemented groups than the control. Supplementation of TEO and GEO in the diet significantly ( $P < 0.05$ ) improved body weight gain, feed consumption and FCR compared to TGEO and CD. It was concluded that using essential oils as feed additives enhanced the overall performance of broiler chicks.

**Keywords:** Body weight, Broiler chickens, Feed intake, Garlic, Thyme

### INTRODUCTION

The Indian poultry industry is one of the agricultural sector's fastest-growing sectors. Feed is the major component of the total costs of poultry ventures as 80 % of the total expenditure is on the procurement of feed. Feed additives are a group of nutrient and non-nutrient compounds that helps in improving the efficiency of feed utilization and thus reducing the high cost of feed. The most often utilized feed additives in the past were antibiotics. Plant-origin natural feed additives are believed to be healthier, safer and less chemically hazardous than synthetic additives. For this reason, interest has arisen to use herbs and herbal products in poultry diets to substitute synthetic additives and to stimulate or improve the efficient utilization of feed nutrients, which can lead to faster body weight gain, higher production rates (Bakkali *et al.*, 2008 and Ismail *et al.*, 2021) and better feed efficiency (Mishra *et al.*, 2020). Furthermore, active components of herbs such as essential oils may help broilers digest their feed and improve meat quality (Ghazalah and Ali, 2008).

However, the results have not been consistent. Therefore, the purpose of the present study was to evaluate the effect of dietary supplementation of garlic and thyme essential oils individually and their

combination on performance parameters and carcass characteristics of broiler chickens.

### MATERIALS AND METHODS

The experiment was conducted from January 2022 to February 2022 at the Department of Poultry Science and Poultry Experimental Station, College of Veterinary Science, Rajendranagar, Hyderabad. To conduct the study, 200-day-old commercial (Vencobb 400) broiler chicks were procured, individually weighed and wing banded. The birds were distributed randomly into 4 dietary treatments, each with 10 replicates having 5 chicks in each replicate. The chicks were reared in battery brooders under standard managerial conditions. The experimental period was from day old to 42 d of age. Broilers were fed on corn-soy-based broiler pre-starter (1-14 d), starter (15-28 d), and finisher (29-42 d) diets and formulated to contain 23%, 22%, and 20% crude protein and metabolizable energy were 3000, 3100 and 3200 kcal/kg, respectively. The treatment consists of a control diet supplemented with no essential oil (CD), a control diet supplemented with thyme essential oil (TEO) or garlic essential oil (GEO) @ 25 g/100kg and thyme and garlic essential oil (TGEO) @ 50 g/100kg.

Weekly body weight, feed intake, and feed conversion ratios were calculated as feed intake per unit body weight gain at weekly intervals. The mortality rate

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was recorded throughout the experiment. On day 42, six birds from each treatment were sacrificed to estimate the various carcass parameters. Broilers were vaccinated against Newcastle Disease (ND) by an ocular route at the 7<sup>th</sup> and 28<sup>th</sup> day of age with the LaSota strain (ND Lasota Vac-500; Indovax Pvt. Ltd. Hyderabad, India).

Data were analyzed for mean, standard errors and analysis of variance using the Snedecor and Cochran (1989) method, and means were compared using the Duncan test (1955) using the Statistical Package for Social Sciences (SPSS) 20.0 version software, with significance set at  $P < 0.05$ .

## RESULTS AND DISCUSSION

### Performance parameters

The data on body weight gain, feed intake (FI), and feed conversion ratio (FCR) as influenced by different dietary treatments is shown in Table 2. During the pre-starter (1-14 d) and starter phases (15-28 d), body weight gain was significantly ( $P < 0.05$ ) higher in the diet supplemented with the TEO group compared to other treatment groups and control, whereas body weight gain of birds fed with GEO and TGEO and control was similar. In the finisher phase (29-42 d), supplementation of thyme and garlic essential oils individually and their combination had shown significantly ( $P < 0.05$ ) higher body weight gain when compared to the birds fed on the control diet. The highest body weight gain was observed in birds fed with TEO compared to the diet supplemented with TGEO, whereas the body weight gain of birds fed with GEO and TGEO was similar. The lowest body weight gain was observed in the control group. This increase in body weight gain might be due to the appetizing and stimulating effects (Demir *et al.*, 2005) of thyme and garlic and stimulate the production of endogenous secretions in the pancreas (Lee *et al.*, 2003) and liver (Cross *et al.*, 2007) and thus improve nutrients utilization through the enhanced liver function (Safa and Al-Beitawi, 2009) and eventually the growth (Slyranda *et al.*, 2011). Similarly, Galli *et al.* (2020) reported that supplementation of thyme in the diet increased the weight gain of broilers when compared to control. Similarly, Sanglimadan *et al.* (2019) reported the addition of garlic

improved the body weight of broilers. Supplementation of thyme and garlic essential oil combinations significantly ( $P < 0.05$ ) improved body weight gain in broilers was reported by Abou-Elnaga *et al.* (2016). Contrary to the above results, Placha *et al.* (2019) and Khaidem *et al.* (2019) did not find any significant changes in body weight gain by supplementation of thyme and garlic, respectively in feed.

The phase-wise feed consumption during pre-starter (1-14 d) and starter phases (15-28 d) was not significantly ( $P > 0.05$ ) influenced by the supplementation of essential oils individually and their combinations. In the finisher phase (29-42 d), feed consumption was significantly ( $P < 0.05$ ) higher in treatment groups supplemented with essential oil individually and their combination when compared to birds fed on the control diet. However, similar feed intake was observed in TEO, GEO, and TGEO. The increase in feed intake might be due to increased palatability of the diet (Umatiya *et al.*, 2018) and also possibly because of the usage of essential fractions of herbs or spices to express positive effects (Bolukbasi *et al.*, 2006). In line with the findings of the present study, Mishra *et al.* (2020) and Borgohain *et al.* (2017) reported that supplementation of thyme and garlic respectively had significantly ( $P < 0.05$ ) improved feed consumption of broilers. Similarly, the supplementation of combinations of essential oil significantly ( $P < 0.05$ ) improved feed consumption in broilers as reported by Rashid *et al.* (2020). However, contrary to our findings, Placha *et al.* (2019) and Khaidem *et al.* (2019) did not find any significant difference in feed consumption by supplementation of thyme and garlic, respectively in the broiler diet.

Statistical analysis on feed conversion ratio (FCR) values revealed that there was no significant ( $P > 0.05$ ) difference among different dietary treatments during pre-starter (0-14 d). However, during the starter (15-28 d) phase, a significantly ( $P < 0.05$ ) better feed conversion ratio was recorded in groups fed with essential oil individually when compared to the birds fed on the control diet. Furthermore, diets supplemented with TEO, GEO, and combinations of essential oils had shown similar FCR, while poor FCR was observed in the control

**Table 1:** Effect of dietary supplementation of thyme and garlic essential oils and their combination on phase wise body weight gain (g) in broiler chicken

| Treatments | Pre starter phase(1-14 d) | Starter phase (15-28 d) | Finisher phase(29-42 d) | Overall BWG (1-42 d) |
|------------|---------------------------|-------------------------|-------------------------|----------------------|
| CD         | 367.58 <sup>b</sup>       | 860.39 <sup>b</sup>     | 801.03 <sup>c</sup>     | 2028.99 <sup>d</sup> |
| TEO        | 380.13 <sup>a</sup>       | 917.51 <sup>a</sup>     | 895.45 <sup>a</sup>     | 2193.09 <sup>a</sup> |
| GEO        | 367.61 <sup>b</sup>       | 892.14 <sup>ab</sup>    | 872.61 <sup>ab</sup>    | 2132.36 <sup>b</sup> |
| TGEO       | 365.34 <sup>b</sup>       | 860.89 <sup>b</sup>     | 846.28 <sup>b</sup>     | 2072.50 <sup>c</sup> |
| SEM        | 0.98                      | 6.14                    | 8.38                    | 9.72                 |
| N          | 10                        | 10                      | 10                      | 10                   |
| P value    | 0.01                      | 0.01                    | 0.01                    | 0.01                 |

Value bearing different superscripts within a column are significantly ( $P < 0.05$ ) different.

group. In the finisher phase (29-42 d), individually (TEO and GEO) in the diet significantly ( $P < 0.05$ ) improved overall FCR when compared to birds fed on a control diet and a combination of thyme and garlic essential oils (TGEO). The improvement in growth performance of broilers might be due to the intestinal environment balance (Nascimento *et al.*, 2000) and stimulating the immune response (Demir and Kilinc, 2008). In agreement with the above results, Al-Kassie (2009) and Toghyani *et al.* (2010) reported that supplementation of thyme in the broiler diet improved FCR. Similarly, Sangilimadan *et al.* (2019) and Rashid *et al.* (2020) reported that the addition of garlic improved FCR compared to control. Furthermore, Witkowska *et al.* (2019) observed that a combination of peppermint and thyme essential oil mist in a broiler diet did not find any significant effect on

feed efficiency. However, contrary to our findings Karim *et al.* (2018) did not find a positive effect on FCR in broilers fed with garlic extract.

#### Carcass parameters

The present experiment revealed that there was no significant ( $P > 0.05$ ) difference in the carcass parameters viz dressing percentage, breast yield, liver weight, heart weight, gizzard weight, and giblet weight between control and other dietary treatment groups supplemented with thyme and garlic essential oils individually and their combination in the diet of broilers. The dietary treatments did not show any significant ( $P > 0.05$ ) difference in slaughter parameters at 42 d of age (Table 3). In agreement with the results of this study, several researchers demonstrated that the addition of thyme (Placha *et al.*, 2019), garlic (Sangilimadan *et al.*, 2019),

**Table 2:** Effect of dietary supplementation of thyme and garlic essential oils and their combination on cumulative feed consumption (g) in broiler chicken

| Treatments | Pre starter phase(1-14 d) | Starter phase (15-28 d) | Finisher phase(29-42 d) | Overall BWG (1-42 d)  |
|------------|---------------------------|-------------------------|-------------------------|-----------------------|
| CD         | 449.28                    | 1335.37                 | 1587.77 <sup>b</sup>    | 3372.41 <sup>b</sup>  |
| TEO        | 467.83                    | 1337.74                 | 1652.67 <sup>a</sup>    | 3458.23 <sup>a</sup>  |
| GEO        | 461.61                    | 1298.69                 | 1701.26 <sup>a</sup>    | 3461.56 <sup>a</sup>  |
| TGEO       | 454.41                    | 1310.9                  | 1667.80 <sup>a</sup>    | 3433.11 <sup>ab</sup> |
| SEM        | 3.88                      | 10.01                   | 11.51                   | 12.26                 |
| N          | 10                        | 10                      | 10                      | 10                    |
| P value    | 0.35                      | 0.39                    | 0.01                    | 0.04                  |

Value bearing different superscripts within a column are significantly ( $P < 0.05$ ) different

**Table 3:** Effect of dietary supplementation of thyme and garlic essential oils and their combination on cumulative feed conversion ratio (FCR) in broiler chicken

| Treatments | Pre starter phase(1-14 d) | Starter phase (15-28 d) | Finisher phase(29-42 d) | Overall BWG (1-42 d) |
|------------|---------------------------|-------------------------|-------------------------|----------------------|
| CD         | 1.22                      | 1.56 <sup>b</sup>       | 1.99 <sup>b</sup>       | 1.66 <sup>c</sup>    |
| TEO        | 1.23                      | 1.46 <sup>a</sup>       | 1.85 <sup>a</sup>       | 1.58 <sup>a</sup>    |
| GEO        | 1.26                      | 1.46 <sup>a</sup>       | 1.96 <sup>b</sup>       | 1.62 <sup>b</sup>    |
| TGEO       | 1.25                      | 1.53 <sup>ab</sup>      | 1.98 <sup>b</sup>       | 1.66 <sup>c</sup>    |
| SEM        | 0.01                      | 0.01                    | 0.02                    | 0.01                 |
| N          | 10                        | 10                      | 10                      | 10                   |
| P value    | 0.66                      | 0.01                    | 0.03                    | 0.01                 |

Value bearing different superscripts within a column are significantly ( $P < 0.05$ ) different

**Table 4:** Effect of dietary supplementation of thyme and garlic essential oils and their combination on carcass parameters and organ weights (% live weight) in broiler chicken

| Treatments | Carcass weight (g) | Dressing percentage (%) | Breast yield (%) | Liver (%) | Heart (%) | Gizzard (%) | Giblet (%) |
|------------|--------------------|-------------------------|------------------|-----------|-----------|-------------|------------|
| CD         | 1507.5             | 66.45                   | 32.42            | 1.75      | 0.5       | 1.63        | 3.88       |
| TEO        | 1545.17            | 67.32                   | 33.98            | 1.88      | 0.46      | 1.64        | 3.98       |
| GEO        | 1560.84            | 67.05                   | 34.27            | 1.83      | 0.51      | 1.59        | 3.93       |
| TGEO       | 1571.34            | 67.26                   | 34.94            | 1.65      | 0.47      | 1.6         | 3.7        |
| SEM        | 12.38              | 0.45                    | 0.53             | 0.04      | 0.01      | 0.03        | 0.06       |
| N          | 6                  | 6                       | 6                | 6         | 6         | 6           | 6          |
| P value    | 0.29               | 0.91                    | 0.78             | 0.27      | 0.62      | 0.89        | 0.35       |

Value bearing different superscripts within a column are significantly ( $P < 0.05$ ) different

and a combination of essential oils (Hosseini *et al.*, 2018) did not result in any significant ( $P>0.05$ ) effect on carcass parameters of broilers. On the contrary, few studies indicated a significant ( $P<0.05$ ) effect on slaughter parameters of broilers with thyme (Shad *et al.*, 2016), and garlic (Motasem *et al.*, 2018). No significant difference in carcass parameters might be due to the dose administered, or the herb selected (Mishra *et al.*, 2020).

## CONCLUSION

Based on the overall results, it is concluded that TEO at 25 g/100 kg or GEO at 25 g/100kg may be supplemented to a broiler diet for improved growth in terms of body weight gain, feed consumption, and feed conversion ratio.

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