Original Research Article

Weekly Assessment of Growth Performance of Broilers Fed Diet Supplemented with Garlic and Turmeric Powder and their Combination

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A B S T R A C T

A total of 120, day-old broiler chicks were divided randomly into 4 treatment (CRD) groups with 3 replicates each i.e. 10 broiler chicks per replicate. Chicks of treatment T1 (control) were fed basal diet without any supplementation. In the treatment group T2, T3 and T4 basal diet was supplemented with 3% garlic powder, 0.5% turmeric powder and 1.5% garlic powder plus 0.25% turmeric powder, respectively. The feeding trial lasted for 6 weeks viz., 0-3 weeks (starter phase) and 3-6 weeks (finisher phase). Body weight of individual chicks and feed intake of each replicate were recorded weekly for 6 weeks and growth performance of broilers was compared between the groups weekly. During 1st week, significant reduction in feed intake of broilers of T2, T3 and T4 as compared to T1. During 2nd week there was significant improvement in FCR only in broilers of T2. During 3rd week, weight gain, FCR and PI were improved significantly in T2 and T4. In 4th week, weight gain, FCR and PI of broilers of T2 and FCR and PI of T4 improved significantly. In 5th week, there was significant improvement in feed intake, weight gain, FCR, PI and PER of T2 broilers as compared to T1, T3 and T4. Similarly, during 6th week, significant improvement in weight gain, feed intake, FCR, PI and PER of T2 broilers. Also, in T4 broilers feed intake, weight gain and performance index increased significantly. In conclusion, 3% garlic powder supplementation to broiler chicks enhanced growth performance.

Keywords
Garlic, Turmeric, Broiler, Growth performance

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Introduction
A variety of feed additives are being included in poultry diet to derive maximum growth of broiler chickens. Over the years, antibiotics are used as growth promoters in animal feeds. Use of in-feed-antibiotics leads to residues in meat and eggs and develops antibiotic resistance in human being consuming the poultry meat and eggs. Recently, many countries tended to prohibit antibiotics because of their side effects on both birds and human. Removing these kinds of growth promoters from broilers diet result in low
growth performance, and also less resistance against diseases. To overcome the poor performance and the increased susceptibility to diseases, attempts have been made to find other alternatives.

Garlic (*Allium sativum*), a member of allium family (liliaceae) is a well known spice. In poultry nutrition, garlic is known to result in improved growth, inhibition of growth of pathogens in the gut, enhanced pancreatic function, and improved meat and carcass quality. Garlic can be used as a feed additive in broiler diets as it improves weight gain and feed conversion ratio (Mahmood *et al*., 2009). This performance improving property is attributed to the antibacterial properties of allicin and ajoene. Supplementation of garlic meal was reported to improve proliferation of absorptive cells in the gut. Dietary garlic supplementation increased villus height, crypt depth and ratio of villus height to crypt depth (Adibmoradi *et al*., 2006). Yason *et al*., (1987) stated that the crypt can be regarded as the villus factory, and a large crypt indicates fast tissue turnover and a high demand for new tissue. An improvement in either villus height or crypt depth may lead to an increase in nutrient absorption and better utility. Turmeric (*Curcuma longa*), a medicinal plant is a rhizomatous herbaceous perennial plant of ginger family, Zingiberaceae. Curcumin (diferuloylmethane) is the main yellow bioactive component of turmeric that has a wide spectrum of biological actions, including antioxidant, antibacterial, antifungal, antiprotozoal, antiviral, antiinflammatory, antihypertensive, and hypocholesteremic activities (Chattopadhyay *et al*., 2004). Other bioactive compounds also exhibit beneficial effects, such as demethoxy curcumin (antioxidant), bisdemethoxy curcumin (antioxidant), and sodium curcuminate (antiinflammatory). Turmeric is also used in gastrointestinal and respiratory disorders. Furthermore, it is used predominantly for internal and external injuries and has a protective effect on aflatoxin-induced mutagenicity. These significant biological properties of turmeric powder make it a potential substitute for infeed antibiotics in livestock diets. Turmeric is well known to have a property as a safe, natural, and residue free phytobiotics (Wang *et al*., 1998). Keeping the above facts in view, the present study was proposed with an aim to formulate a better herbal feed additive with turmeric and garlic for broiler birds to improve growth performance.

**Materials and Methods**

A feeding trial was conducted on day old 120, broiler chicks in a completely randomised design (CRD). Garlic and turmeric powders were incorporated in a basal diet for a period of 42 days starting from day- old stage. Basal feeds were procured separately for starter (0-3 weeks) and finisher (4-6 weeks) phases of growth to meet the requirements of all the essential nutrients for growing broiler chicken as per BIS specification (1997). Physical and chemical composition of feed is given in Table 1. There were four dietary treatment groups (T1, T2, T3 and T4) each with three replicates with ten birds in each replicate. Garlic powder, turmeric powder and its combination were supplemented in the broilers basal diet for a period of 6 weeks. Treatment T1 served as control in which broiler chicks were offered basal diet without any supplementation, treatment T2 was supplemented with 3% garlic powder, treatment T3 was supplemented with 0.5% turmeric powder and treatment T4 was supplemented with 1.5% garlic + 0.25% turmeric powders. The experimental feeds and water were provided *ad libitum*. For the study of growth performance, body weight of individual chick and feed consumption of each replicate group was recorded weekly upto 6th week of age. Then, feed conversion...
ratio (FCR), performance index (PI) and protein efficiency ratio (PER) were calculated.

**Results and Discussion**

**1st week**

Feed intake of broilers in T2 (134.52 g), T3 (132.60 g) and T4 (134.13 g) groups was significantly (P<0.05) lowered than to T1 (138.97 g). Average body weight, body weight gain, feed conversion ratio (FCR), performance index and protein efficiency ratio (PER) showed no significant difference among the broilers of different treatment groups due to dietary supplementation of garlic and turmeric powder during the 1st week of feeding trial.

**2nd week**

No significant difference (P>0.05) was observed in feed intake, average body weight, weight gain, performance index (PI) and protein efficiency ratio (PER) among broilers of different treatment groups during 2nd week of feeding trial. FCR was improved in broilers of treatment T2 (1.613) fed garlic powder supplemented diet compared to other treatment groups (T1, T3 and T4).

**3rd week**

During 3rd week of feeding trial, feed intake and protein efficiency ratio was statistically similar among different treatment group of broilers. Body weight of broilers of garlic powder supplemented group T2 (540.50 g) was significantly (P<0.05) increased as compared to other treatment groups T1 (533.49 g), T3 (534.67g) and T4 (536.41 g). The body weight gain and FCR of broilers during 15-21 days was significantly (P<0.05) higher in garlic (254.23 g) and garlic plus turmeric powder (252.83 g) supplemented group as compared to control group (247.92 g) and it was 251.16 g in turmeric supplemented group. Broilers of treatment T2 (152.73) group showed highest performance index during this period followed by T4 (151.44), T3 (149.89) and T1 (146.49) groups of broilers.

**4th week**

During this period, feed intake and protein efficiency ratio ofbroilers of different treatment groups was statistically (P>0.05) similar. Highest body weight of broiler chicks was recorded in treatment group T2 (848.96g) followed by T4 (842.29g), T3 (835.77g) and T1 (834.21g). There was significantly (P<0.05) higher weight gain in broiler chicks of treatment T2 (308.46 g) than other treatment groups 300.72, 301.10 and 305.89, respectively, in T1, T3 and T4. However, there was significant (P<0.05) improvement in FCR and Performance index of broilers of treatment T2 and T4 as compared to treatments T3 and T1.

**5th week**

Maximum feed intake was recorded in broilers of treatment T2 and was significantly (P<0.05) higher than treatment groups T1, T3 and statistically similar with T4. Body weight of broilers of treatment groups T2 and T4 showed significant (P<0.05) improvement as compared to control group T1. Significantly (P<0.05) higher weight gain and performance index was recorded in treatment T2 as compared to other treatments groups viz., T1, T3 and T4. There was significant (P<0.05) improvement in FCR and protein efficiency ratio of broilers of treatment group T2 (3.085) as compared to other treatment groups.

**6th week**

Feed intake, body weight and performance index of broilers of treatment T2 and T4 was significantly (P<0.05) higher than that of
treatment T₁ whereas feed intake, body weight and performance index of broilers of treatment T₃ was statistically similar with control group T₁. FCR also improved significantly (P<0.05) in garlic powder supplemented group T₂ as compared to other treatments groups. During 36-42 days maximum weight gain was observed in T₂ (447.72 g) and was higher (P<0.05) as compared to weight gain T₁, T₃ and comparable with T₄. Protein efficiency ratio of broilers of garlic powder supplemented treatment group T₂ (3.013) was significantly (P<0.05) better than other treatment groups T₁ (3.048), T₃ (3.053) and T₄ (3.038).

Table.1 Ingredient and chemical composition (%) of the basal diets

| Feed ingredients                          | Broiler starter diet (0-3 wks) | Broiler finisher diet (4-6 wks) |
|-------------------------------------------|--------------------------------|---------------------------------|
| Maize                                     | 55.00                          | 60.00                           |
| Deoiled soyabean meal                     | 36.00                          | 32.00                           |
| Rice polish                               | 4.60                           | 3.10                            |
| Soyabean oil                              | 0.50                           | 1.00                            |
| Marble stone                              | 1.00                           | 1.00                            |
| Dicalcium phosphate                       | 2.00                           | 2.00                            |
| DL- Methionine                            | 0.10                           | 0.10                            |
| Coccidiostat (Meduramycin)                | 0.05                           | 0.05                            |
| Copper sulphate                           | 0.01                           | 0.01                            |
| Common salt                               | 0.30                           | 0.30                            |
| Merivite -100 (Vitamin B12)               | 0.02                           | 0.02                            |
| Phosphoric acid                           | 0.10                           | 0.10                            |
| Lipocare (choline chloride)               | 0.05                           | 0.05                            |
| Hepatocare                                | 0.10                           | 0.10                            |
| Vitamin mixture                           | 0.03                           | 0.03                            |
| Trace minerals                            | 0.14                           | 0.14                            |
| **Chemical Composition**                  |                                |                                 |
| Moisture                                  | 9.20                           | 10.90                           |
| Crude protein                             | 22.16                          | 20.81                           |
| Crude fibre                               | 4.00                           | 4.00                            |
| Ether extract                              | 4.50                           | 4.25                            |
| Metabolizable energy (kcal/kg) calculated | 2877.00                        | 2946.00                         |
| Nitrogen- free extract                     | 62.54                          | 64.44                           |
| Total Ash                                 | 6.80                           | 6.50                            |
| Acid insoluble ash                        | 1.35                           | 1.30                            |
| Calcium                                   | 1.24                           | 1.21                            |
| Phosphorus                                | 0.79                           | 0.77                            |
Table 2: Average growth performance of broiler chicks from 0-7 days fed diets supplemented with garlic and turmeric powder

| Parameters                        | Treatments/ Groups                          |
|-----------------------------------|---------------------------------------------|
|                                   | T<sub>1</sub>          | T<sub>2</sub>          | T<sub>3</sub>          | T<sub>4</sub>          |
| Control                          | Garlic (3%)           | Turmeric (0.5%)        | Garlic (1.5%) + Turmeric (0.25%) |
| Initial body weight (g)          | 41.20 ± 0.15          | 41.23 ± 0.03           | 41.20 ± 0.05           | 41.20 ± 0.11          |
| Body weight at 7<sup>th</sup> day (g) | 135.13 ± 0.70       | 132.77 ± 1.39           | 131.97 ± 0.94           | 132.93 ± 1.48       |
| Weight gain (g)                  | 93.93 ± 0.83          | 91.53 ± 1.37           | 90.77 ± 0.92           | 91.73 ± 1.36          |
| Feed intake (g)*                 | 138.97<sup>a</sup> ± 0.59 | 134.52<sup>b</sup> ± 0.69 | 132.60<sup>b</sup> ± 1.10 | 134.13<sup>b</sup> ± 2.23 |
| Feed conversion ratio            | 1.480 ± 0.006         | 1.470 ± 0.016          | 1.461 ± 0.021          | 1.462 ± 0.011         |
| Performance index                | 63.50 ± 0.85          | 62.30 ± 1.58           | 62.16 ± 1.44           | 62.74 ± 1.06          |
| Protein efficiency ratio         | 3.376 ± 0.015         | 3.377 ± 0.036          | 3.420 ± 0.048          | 3.410 ± 0.026         |

<sup>a, b</sup> values bearing different superscripts in a row differ significantly * P<0.05

Table 3: Average growth performance of broiler chicks from 8-14 days fed diets supplemented with garlic and turmeric powder

| Parameters                        | Treatments/ Groups                          |
|-----------------------------------|---------------------------------------------|
|                                   | T<sub>1</sub>          | T<sub>2</sub>          | T<sub>3</sub>          | T<sub>4</sub>          |
| Control                          | Garlic (3%)           | Turmeric (0.5%)        | Garlic (1.5%) + Turmeric (0.25%) |
| Body weight at 14<sup>th</sup> day (g) | 285.57 ± 0.77       | 286.27 ± 1.16           | 282.51 ± 0.56           | 283.58 ± 0.69       |
| Weight gain (g)                  | 150.43 ± 0.67         | 153.50 ± 0.64           | 150.55 ± 0.95           | 150.65 ± 1.18        |
| Feed intake (g)                  | 245.53 ± 0.71         | 247.67 ± 0.75           | 246.30 ± 0.66           | 245.00 ± 1.27        |
| Feed conversion ratio*           | 1.632<sup>a</sup> ± 0.002 | 1.613<sup>b</sup> ± 0.001 | 1.636<sup>a</sup> ± 0.005 | 1.626<sup>ab</sup> ± 0.005 |
| Performance index*               | 92.17 ± 0.56          | 95.14 ± 0.51           | 92.02 ± 0.92           | 92.64 ± 1.00         |
| Protein efficiency ratio         | 3.060 ± 0.004         | 3.076 ± 0.003          | 3.053 ± 0.011          | 3.067± 0.009         |

<sup>a, b</sup> values bearing different superscripts in a row differ significantly * P<0.05
Table 4 Average growth performance of broiler chicks from 15-21 days fed diets supplemented with garlic and turmeric powder

| Parameters                              | Treatments/ Groups                                      |
|-----------------------------------------|---------------------------------------------------------|
|                                         | T1            | T2                | T3                | T4                |
| Control                                 | 533.49± 0.69  | 540.50± 0.82      | 534.67± 1.0       | 536.41± 1.54      |
| Body weight at 21st day (g)*            | 247.92± 0.93  | 254.23± 1.08      | 251.16± 1.52      | 252.83± 0.90      |
| Weight gain (g)*                        | 419.57 ± 1.03 | 423.20 ± 0.65     | 420.87 ± 1.20     | 422.10 ± 0.40     |
| Feed intake (g)                         | 1.692± 0.002  | 1.665bc± 0.006    | 1.675ab± 0.006    | 1.669b± 0.005     |
| Feed conversion ratio*                  | 146.49± 0.74  | 152.73± 1.21      | 149.89ab± 1.47    | 151.44a± 1.07     |
| Protein efficiency ratio                | 2.952± 0.004  | 2.981± 0.011      | 2.981± 0.011      | 2.987± 0.010      |

*a, b, c values bearing different superscripts in a row differ significantly * P<0.05

Table 5 Average growth performance of broiler chicks from 22-28 days fed diets supplemented with garlic and turmeric powder

| Parameters                              | Treatments/ Groups                                      |
|-----------------------------------------|---------------------------------------------------------|
|                                         | T1            | T2                | T3                | T4                |
| Control                                 | 834.21± 2.31  | 848.96a± 1.12     | 835.77c± 0.93     | 842.29b± 1.42     |
| Body weight at 28th day (g)*            | 300.72± 1.62  | 308.46a± 1.89     | 301.10b± 1.51     | 305.89ab± 1.39    |
| Weight gain (g)*                        | 521.20 ± 0.91 | 523.63 ± 2.54     | 521.60 ± 1.04     | 522.47± 0.63      |
| Feed intake (g)                         | 1.733± 0.006  | 1.698b± 0.004     | 1.732a± 0.005     | 1.708b± 0.008     |
| Feed conversion ratio*                  | 173.51b± 1.59 | 181.71a± 1.47     | 173.82b± 1.39     | 179.10a± 1.70     |
| Protein efficiency ratio                | 3.149± 0.0111 | 3.147 ± 0.008     | 3.154± 0.009      | 3.165± 0.015      |

*a, b, c values bearing different superscripts in a row differ significantly * P<0.05
Table 6 Average growth performance of broiler chicks from 29-35 days fed diets supplemented with garlic and turmeric powder

| Parameters                              | Treatments/ Groups                                                                 |
|-----------------------------------------|-----------------------------------------------------------------------------------|
|                                         | T1       | T2                  | T3                  | T4                  |
|                                         | Control  | Garlic (3%)         | Turmeric (0.5%)     | Garlic (1.5%) + Turmeric (0.25%) |
| Body weight at 35th day (g)*            | 1253.02c ± 1.92 | 1276.70a ± 2.32     | 1255.75c ± 0.47     | 1264.75b ± 0.30     |
| Weight gain (g)*                        | 418.81b ± 1.67 | 427.73a ± 1.27      | 420.98b ± 1.31      | 422.45b ± 1.31      |
| Feed intake (g)*                        | 734.80b ± 1.36 | 740.63a ± 1.13      | 736.57b ± 0.82      | 737.63ab ± 1.27     |
| Feed conversion ratio*                  | 1.754a ± 0.004 | 1.732b ± 0.002      | 1.750a ± 0.003      | 1.746a ± 0.003      |
| Performance index*                      | 238.71b ± 1.48 | 247.03a ± 1.12      | 240.61b ± 1.27      | 241.94b ± 1.24      |
| Protein efficiency ratio*               | 3.111ab ± 0.007 | 3.085c ± 0.005      | 3.123a ± 0.006      | 3.096bc ± 0.006     |

a, b, c values bearing different superscripts in a row differ significantly * P<0.05

Table 7 Average growth performance of broiler chicks from 36-42 days fed diets supplemented with garlic and turmeric powder

|Parameters                           | Treatments/ Groups                                                                 |
|--------------------------------------|-----------------------------------------------------------------------------------|
|                                      | T1       | T2                  | T3                  | T4                  |
|                                      | Control  | Garlic (3%)         | Turmeric (0.5%)     | Garlic (1.5%) + Turmeric (0.25%) |
| Body weight 42th day (g)             | 1694.11c ± 0.70 | 1724.41a ± 3.31     | 1697.54c ± 1.59     | 1710.12b ± 1.04     |
| Weight gain (g)*                     | 441.08b ± 1.24 | 447.72a ± 1.04      | 441.79b ± 1.15      | 445.37ab ± 1.12     |
| Feed intake (g)*                     | 790.00c ± 0.38 | 793.87a ± 0.76      | 790.77hc ± 0.94     | 792.53ab ± 0.32     |
| Feed conversion ratio                | 1.791a ± 0.004 | 1.773bc ± 0.002     | 1.793a ± 0.003      | 1.780b ± 0.003      |
| Performance index                    | 246.27c ± 1.27 | 252.50a ± 0.94      | 246.82bc ± 1.33     | 250.28ab ± 1.17     |
| Protein efficiency ratio             | 3.048a ± 0.007 | 3.013b ± 0.004      | 3.053a ± 0.006      | 3.038a ± 0.006      |

a, b, c values bearing different superscripts in a row differ significantly * P<0.05

During 0-7 days there was significantly less feed intake in broilers due to garlic and turmeric powder supplementation in diet which might be due to repulsive odour and taste of garlic and turmeric powder. The increase in growth performance in broilers due to feeding of garlic powder supplemented diet might be attributed to allicin, component
of garlic which promotes the performance of intestinal flora, thereby improving digestion and utilization of nutrients by increasing villi length and width of intestine leading to improved growth performance (Lewis et al., 2003). The growth performance of broilers fed turmeric supplemented diet did not show significant difference from control group. Performance of garlic plus turmeric powder supplemented group of broilers significantly increased as compared to control group of broilers which might be due to growth promoting effect of garlic.

The present results indicated that dietary garlic powder supplementation significantly improved growth performance and are in agreement with the findings of Pourali et al., (2010), Onyimonyi et al., (2011) and Oladele et al., (2012) who reported that garlic powder has positive effects on growth performance. Abou-Elkhair et al., (2014) and Akbarian et al., (2012) who reported that growth performance of broilers was not influenced by inclusion of turmeric in the diet. On the contrary, Raghdad (2012) and Swathi et al., (2012) reported that addition of turmeric powder in the diet of broilers had significant improvement in body weight and feed conversion ratio.

From the present investigation it can be concluded that supplementation of garlic @30g/ kg of feed of broiler chicks improved growth performance whereas turmeric powder supplementation @ 5g/kg of feed of broiler chicks did not altered growth performance.

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