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# Effect of feeding turmeric (*Curcuma longa*) powder on the meat quality of broilers

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**Abstract**
An experiment was conducted on day-old and vaccinated 105 broiler chicks to investigate that the feeding of Turmeric (*Curcuma longa*) powder on the meat quality of broilers. In that experiment the treatments were depends upon the levels of turmeric powder (0.5%, 1%, 2% and 3%) and control group was served as basal diet. The broilers were divided into 5 groups (21 chicks per group). Meat quality of the birds were analyzed at the end of experiment. The results indicated that addition of turmeric powder caused significant (P<0.05) increase in carcass weight and dressing percentage. The results confirmed the beneficial effects of feeding curcuma longa powder to improve meat quality of broilers.

**Keywords:** curcuma longa powder, broilers, meat quality

## Introduction
In India, there are 481.83 lakhs backyard poultry and the total poultry population in the country is 729.2 million numbers increased by 12.39 per cent over previous census (2007) in which 95 per cent of fowl, 3 per cent duck, 2 per cent turkey and other. Poultry contribute 16.3 per cent to total meat production in India. Poultry population in Maharashtra is 175.07 lakhs and on third position in the country and share about 10.67 per cent total poultry population of India. (Anonymous, 2012) [3].

Broilers are marketed at an age of around 35 to 42 days. Broiler production is a short-term enterprise. Broilers have high feed conversion ratio, only a minimum amount of feed required for unit body weight gain in comparison to other livestock. Demand for poultry meat is more as compared to sheep/goat meat. Poultry meat is an important source of high quality proteins, minerals and vitamins to balance the human diet.

Turmeric (*Curcuma longa*) is a rhizomatous herbaceous perennial herb; it is widely used and cultivated in India. The active ingredients of turmeric are curcumin, demethoxycurcumin, bisdemethoxycurcumin and colorless metabolites tetrahydrocurcumin. Turmeric has antioxidant, antibacterial, antifungal, antiprotozoal, antiviral, antiinflammatory, anticarcinogenic, antihypertensive, and hypo-cholesteremic activities.

## Materials and methods
An experiment was conducted on 105 day old and vaccinated broiler chicks, randomly distributed in 5 groups containing 21 chicks for each group and fed as per specification of Bereau of Indian Standards. Birds were reared in deep litter system and given feed and water *ad libitum*. Treatments were as $T_1$ - (control), $T_2$ - supplemented with 0.5% turmeric powder, $T_3$ - supplemented with 1 % turmeric powder, $T_4$ – supplemented with 2% turmeric powder and $T_5$ – supplemented with 3% turmeric powder. All formulation provided with basal ration. At the end of $35^{th}$ day of age, one bird from each replicates was randomly picked up and slaughter for meat analysis. The meat analysis as per following mentioned parameters.

## Meat quality
For evaluating the effect of treatments on the meat quality and quantity, one bird from each treatment was randomly selected and sacrificed at the end of the fifth week of their age i.e. at the termination of the experiment.

## Carcass yield
The carcass evaluation was carried out as per Pande (2003) [13]. The birds were randomly selected from each group for dressed yield and edible carcass yield studies.

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At the end of experiment the birds were kept separately and fasted for a period of 12 hours. Prior to their slaughter the live weight of the birds were recorded. The birds were slaughtered by cutting the throat transversory close to head. The pelt was removed properly with knife and hand pressure technique.

After removal of feathers and complete bleeding, the dressed yield of each bird was recorded. The complete digestive tract, legs and head were removed to calculate edible carcass yield of individual bird. Heart, liver, and gizzard were also weighed individually and the average yield of each of these organs was recorded for the respective groups. The percentage of dressed yield, edible carcass yield and weight of different organs were calculated over live weights.

## Dressing yield (%)
Dressing percentage was calculated as per the following formula.

$$\text{Dressing percentage} = \frac{\text{Carcass weight}}{\text{Live weight}} \times 100$$

## Sensory evaluation for meat quality
To evaluate the quality of collected chicken meat samples were subjected for sensory evaluation by semi-trained taste panel of 20 members. The meat piece prepared from meat sample. Two per cent salt added in water for preparation of brine solution. Samples were cooked in brine solution in the pressure cooker for 15 minutes. After cooking, the samples were separated from solution and cooled to room temperature. A panel of 20 semi-trained judges was selected for sensory evaluation. A nine point hedonic scale was used to evaluate the sample for tenderness, flavour, juiciness, overall acceptance.

## Meat analysis
Feeds and meat were analysed for the following proximate principles as per A.O.A.C. (2005) [1]:
1. Dry matter
2. Crude protein
3. Crude fiber
4. Crude fat
5. Nitrogen free extract
6. Total ash

## Statistical analysis
The statistical analysis of the data obtained for meat quality were carried out as per Snedecor and Cochran (1994) [14] using Randomized Block Design.

## Results and discussion
### Chemical composition of Broiler feed and Turmeric
The commercial broiler starter, broiler finisher, and turmeric powder were used for this experimental trial. The chemical composition is given in Table 1.

Composition of Turmeric powder observed in the present investigation was in agreement with that Ikpeama *et al.* (2014) [9] reported that chemical composition of turmeric that dry matter, ash content, crude fiber, crude protein and fat was 91.0, 2.85, 4.60, 9.40 and 6.85 per cent, respectively.

### Carcass weight and dressing percent
Pre-slaughter weight of broiler, carcass weight and dressing percentage at the age of 35 days were presented in Table 2.
It was observed that the pre-slaughter weight was 1.682,

1.947, 1.875, 1.745, 1.710 kg, respectively for the groups $T_1$, $T_2$, $T_3$, $T_4$ and $T_5$. The maximum Pre-slaughter weight observed in the treatment $T_2$ (1.947) and minimum in $T_1$ (1.682 kg).

The highest carcass weight obtained in the treatment $T_2$ (1.425) followed by treatments $T_3$ (1.287), $T_4$ (1.257), $T_5$ (1.231) and $T_0$ (1.194 kg). Treatment groups $T_3$ (1.287) and $T_4$ (1.257) were at par with each other and differed significantly than $T_0$ (1.194 kg).

Also, the dressing percentage for the groups $T_1$, $T_2$, $T_3$, $T_4$ and $T_5$ were as 70.98, 73.18, 72.37, 72.03 and 71.98, respectively. The dressing percentage value of the group $T_2$ (73.18) was higher than all other groups followed by treatments $T_3$ (72.37), $T_4$ (72.03), $T_5$ (71.98), and $T_1$ (70.98). Also, treatments $T_3$, $T_4$ and $T_5$ were at par with each other and all groups differed significantly than the $T_1$ (70.98) treatment.

The findings were in agreement with Kamal (2011) [10] fed broilers with treatments viz. control, 0.2, 0.4 per cent garlic powder with basal feed and obtained dressing percentage as 70.5, 70.5 and 70.9, respectively. Elagib *et al.* (2013) [6] found that higher dressed weight and dressing percentage in the treatment 3 per cent garlic powder.

Similarly, Mehala *et al.* (2008) [12] observed that birds fed with 0.2 per cent turmeric powder having highest dressed weight 1790.38 g and dressing percentage 77.43. Durrani *et al.* (2006) [5] reported that broilers fed with 0.50 per cent turmeric powder having higher dressing per cent than other treatment groups.

### Chemical composition of chicken meat
From the data, it was revealed that the chemical composition did not vary significantly due to addition of Turmeric powder. The dry matter content in the treatments $T_1$, $T_2$, $T_3$, $T_4$ and $T_5$ in chest meat were 22.4, 24.8, 25.2, 21.45 and 22.85 per cent, respectively and thigh meat were 29.8, 26.05, 25.8, 26.25 and 25.15 per cent, respectively. Highest dry matter obtain in the treatment $T_3$ (25.2 per cent) and lowest in treatment $T_4$ (21.45 per cent) in the chest meat and in the thigh meat highest dry matter in the treatment $T_4$ (26.25 per cent) and lowest in the treatment $T_5$ (25.15 per cent). The highest dry matter was obtained in thigh meat as compared to chest meat.

The crude protein content in the treatments $T_1$, $T_2$, $T_3$, $T_4$ and $T_5$ in chest meat were 20.41, 23.33, 24.79, 25.10 and 23.64 per cent, respectively and in thigh meat were 17.50, 20.41, 23.33, 21.87 and 18.95 per cent, respectively. Protein percentage in the chest meat was higher than the thigh meat.

The fat contain in the treatments $T_1$, $T_2$, $T_3$, $T_4$ and $T_5$ in chest meat were 2.78, 1.12, 1.19, 1.27 and 1.38 per cent, respectively and in thigh meat were 4.12, 3.21, 3.68, 3.76 and 3.89 per cent, respectively and fat in the thigh meat was higher than the chest meat.

The ash percent in the treatments $T_1$, $T_2$, $T_3$, $T_4$ and $T_5$ in chest meat were 0.5, 0.9, 1.0, 0.4 and 0.6 per cent, respectively and in thigh meat were 0.8, 0.7, 0.6, 0.6 and 0.5 per cent, respectively. The highest ash per cent of the chest and thigh meat.

These results were agreement with Kim *et al.* (2008) [11] in garlic bulb (2 and 4%) and garlic husk (2 and 4%) supplementation resulted in a higher protein content and lower fat content in thigh muscle of chicks compared with muscle from birds fed non supplemented diets. Choi *et al.* (2010) [4] observed that 3 per cent garlic powder effectively increased the crude protein and decreased fat and ash than 0, 1, and 5 percent garlic.

Similarly, Hussain (2013) [8] recorded that significant increase of crude protein (P<0.05) in chest meat and significant decrease of ether extract (P<0.05) in thigh meat in broilers supplemented with turmeric powder 7 g/ kg diet than other treatments (0, 5, 9 g/ kg diet). Also, Al-Sultan (2003) [2] investigated that protein per cent in breast and thigh muscles of birds in different treated and control groups were found nearly the same. The lower fat percentage (1.0 %) was recorded in carcasses of birds received 1.0 % turmeric followed by 0.5, control and 0.25 %.

**Sensory evaluation of chicken meat**
The average score of sensory evaluation are presented in the Table 4. The mean score of sensory evaluation did not differed significantly in treatment groups and control. In the case of the chest meat the highest value of the tenderness, flavour, juiciness and overall acceptance were in treatments $T_2L_1$ (8.4), $T_2L_1$ (8), $T_2L_1$ (7.75) and $T_2L_1$ (8.05) and lowest in

treatments $T_4$ (7.25), and $T_4$ (7.08), respectively.
In the case of the thigh meat the highest value of the tenderness, flavour, juiciness and overall acceptance were in the treatments $T_2$ (8.25), $T_1$ (7.85), $T_4$ (7.71) and $T_2$ (7.78), respectively. The results of sensory evaluation revealed that feeding of turmeric did not induce any abnormal colour, flavour or smell in chicken meat.
The results were in agreement with AL-Sultan (2003) [2] revealed that turmeric did not induce any abnormal flavour, colour or smell and 0.5 per cent treatment was excellent followed by 1 per cent, control and 0.25 per cent.
Similarly, Fadlalla et al. (2010) [7] investigated that 0, 0.15, 0.30, 0.45 and 0.60 per cent garlic powder in diet did not produced significant differences among dietary treatments in the tested characteristics (Colour, Flavour, tenderness, juiciness.). Kim et al. (2008) [11] noted that supplementing broiler chicken diets with garlic can enhance eating quality.

**Table 1:** Chemical composition of experimental feed ingredients (per cent DM basis)

| Proximate Principles | DM | CP | CF | EE | NFE | TA |
|---|---|---|---|---|---|---|
| Broiler starter | 90.33 | 21.87 | 6.56 | 4.46 | 60.67 | 6.43 |
| Broiler finisher | 89.10 | 18.95 | 6.23 | 4.25 | 65.37 | 5.20 |
| Turmeric powder | 90.33 | 11.66 | 3.40 | 6.37 | 74.97 | 3.60 |

DM- Dry matter, CP- Crude protein, CF- Crude fiber, EE- Ether extract, NFE- Nitrogen free extract, TA- Total ash

**Table 2:** Pre-slaughter weight, carcass weight and dressing percentage of broiler at 35th day

| Treatments | Pre-slaughter weight (kg) | Carcass weight (kg) | Dressing percentage |
|---|---|---|---|
| $T_1$ | 1.682$^d$ | 1.194$^d$ | 70.98$^e$ |
| $T_2$ | 1.947$^a$ | 1.425$^a$ | 73.18$^a$ |
| $T_3$ | 1.875$^b$ | 1.287$^b$ | 72.37$^{bc}$ |
| $T_4$ | 1.745$^c$ | 1.257$^{bc}$ | 72.03$^{cd}$ |
| $T_5$ | 1.710$^{cd}$ | 1.231$^c$ | 71.98$^{cd}$ |
| SEd ± | 0.020 | 0.020 | 0.20 |
| C. D. @ 5 % | 0.043 | 0.043 | 0.43 |

(P < 0.05) Means with different superscripts differed significantly

**Table 3:** Chemical composition of chicken meat at 35th day

| Characters | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ | SEd ± | CD 5% |
|---|---|---|---|---|---|---|---|
| Chest meat (%) | | | | | | | |
| Dry matter | 22.4 | 24.8 | 25.2 | 21.45 | 22.85 | 0.50 | NS |
| Crude protein | 20.41 | 23.33 | 24.79 | 25.10 | 23.64 | 3.65 | NS |
| Ether extract | 2.78 | 1.12 | 1.19 | 1.27 | 1.38 | 0.62 | NS |
| Ash | 0.5 | 0.9 | 1.0 | 0.4 | 0.6 | 0.12 | NS |
| Thigh meat (%) | | | | | | | |
| Dry matter | 29.8 | 26.05 | 25.8 | 26.25 | 25.15 | 1.72 | NS |
| Crude protein | 17.50 | 20.41 | 23.33 | 21.87 | 18.95 | 1.83 | NS |
| Ether extract | 4.12 | 3.21 | 3.68 | 3.76 | 3.89 | 0.61 | NS |
| Ash | 0.8 | 0.7 | 0.6 | 0.6 | 0.5 | 0.10 | NS |

**Table 4:** Average value of Sensory evaluation of chicken meat at 35th day

| Characters | $T_1$ | $T_2$ | $T_3$ | $T_4$ | $T_5$ |
|---|---|---|---|---|---|
| Chest meat (out of 9 points) | | | | | |
| Tenderness | 7.75 | 8.40 | 8.25 | 7.75 | 7.58 |
| Flavour | 7.33 | 8.00 | 7.50 | 7.25 | 7.60 |
| Juiciness | 7.50 | 7.75 | 7.58 | 7.25 | 7.25 |
| Overall acceptance | 7.52 | 8.05 | 7.77 | 7.08 | 7.47 |
| Thigh meat (out of 9 points) | | | | | |
| Tenderness | 7.10 | 8.25 | 7.50 | 7.80 | 7.57 |
| Flavour | 7.85 | 7.71 | 7.42 | 7.50 | 7.57 |
| Juiciness | 7.64 | 7.64 | 7.14 | 7.71 | 7.35 |
| Overall acceptance | 7.55 | 7.78 | 7.35 | 7.67 | 7.33 |

**Conclusion**

It was concluded that feeding of 0.5 per cent turmeric powder significantly improved meat quality than other groups.

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