# Effect of turmeric (*Curcuma longa)* supplementation on antioxidants and immunity of broiler birds

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## Abstract

To asses the effect of turmeric (*Curcuma longa)* supplementation on antioxidants and immunity of broiler chickens, seventy five run day old coloured synthetic broiler chicks were randomly divided into 3 groups (25 chicks per each) of mixed sex. Group I served as control (without any supplementation), whereas birds in groups II and III were supplemented with 0.5% and 1.0% *Curcuma longa powder* respectively and the trail was lasted for 7 weeks. Blood samples were collected at the end of the experiment to study the antioxidant enzyme status and immunity of birds. The results indicated that addition of *Curcuma longa* powder caused significant ($P<0.05$) increase in antioxidant enzyme status of birds. The cellular immune response of broiler birds to phytoheamagltinin-P and antibody titre to sheep red blood cells was significantly ($P < 0.05$) higher in treated group than un-supplemented control birds. The present results confirmed the beneficial effects of dietary *Curcuma longa* powder to improve antioxidant enzymes and immune status of broiler chickens.

**Key words:** Antioxidants; Broilers; Immunity; Turmeric

# Introduction

Turmeric (*Curcuma longa*) is a medicinal plant used as a food additive in curries to improve the storage condition, appearance, flavour, palatability and preservation of food. Turmeric has antioxidant, antibacterial, antifungal, antiprotozoal, antiviral, antiinflammatory, anticarcinogenic, antihypertensive, and hypo cholesteremic activities (Chen and Huang, 2009). Main anti-oxidant enzymes constituting the first line of anti-oxidant enzymatic defenses are superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase. SOD catalyzes dismutation of superoxide radicals to hydrogen-peroxide and oxygen; CAT catalyzes the breakdown of hydrogen-peroxide to water and molecular oxygen (Halliwell, 2006). Turmeric powder enhanced the antioxidant status of heat stressed broilers via improving the activity of glutathione peroxidase and superoxide dismutase and decreasing the concentration of malondialdehyde (MDA) (Zeinali *et al.*, 2011). Turmeric powder has demonstrated to be a potent immunomodulatory agent that can modulate the activation of T cells, B cells, macrophages, neutrophils, natural killer cells and dendritic cells (Ganesh and Bharat, 2007). Therefore, an experiment was conducted on broiler chicken to find out the effect of turmeric supplementation on their antioxidant enzymes and immunity status.

# Materials and methods

An experiment was conducted on 75 straight run day old coloured synthetic broiler chicks, randomly distributed in 3 groups containing 25 chicks each and fed as per BIS (1992). Birds were reared in deep litter system and given feed and water *ad lib*. Broiler birds were given broiler starter feed from 0 to 3$^{rd}$ weeks and broiler finisher diet from 4$^{th}$ to 7$^{th}$ week. The ground turmeric powder was procured from local market of Bhubaneswar, Odisha, India. Treatments were: group I (control), group II supplemented with 0.5% turmeric powder, group III supplemented with 1 % turmeric powder through the concentrate mixture.Various rations were also analysed for proximate composition (AOAC, 2005).

Lipid peroxidation (LPO) in RBC hemolysate was determined by Placer *et al*. (1966) and the concentration CAT was assayed in erythrocytes by the method of (Bergmeyer, 1983). Superoxide dismutase (SOD) activity of RBC haemolysate samples was measured using nitro blue tetrazolium as a substrate (Minami and Yoshikawa, 1979).

At 7 weeks of age, five birds from each dietary treatment were injected intra-dermally in the right wattle with 100 micro gram of Phytohaemaglutinin-P (PHA-P) in 0.1 ml of normal saline to measure the cellular immune response by Cutaneous Basophillc Hyper Sensitivity (CBH) test (Edelmen *et al.*, 1986). The thickness of wattle was measured using digital calliper before injection and 24 h post injection and CBH response was calculated using the formula:

$$\text{CBH response} = \frac{\text{Pre-injection thickness}}{\text{Post-injection skin thickness}} \times 100$$

The measure of humoral immunity was carried out by using sheep RBC as per the method described by (Abdallah *et al.*, 2009). The data were analysed by Statistical Package for Social Science (SPSS) software version 16.

# Results

The composition and proximate analysis of different rations has been shown in Table 1. The crude protein content (%) of the broiler starter and broiler finisher was 22.75 and 20.09 respectively. The protein and energy requirement was as per the BIS (1992) requirement.

Result reveled that SOD and CAT activity were significantly ($P<0.05$) higher in group II and III at 7wks as compared to control group indicating that the supplementation of turmeric either 0.5 or 1% in the ration significantly improved the SOD and CAT activity. The mean malonaldehyde concentration was significantly ($P<0.05$) different among different groups being 3.38, 2.16 and 2.19 µmol/mg Hb indicating that supplementation of turmeric prevents lipid peroxidation in poultry (Table 2).

The cellular immune response of broiler birds to PHA-P was significantly higher in higher turmeric fed groups with group III recorded highest response. The influence on primary antibody titer to Sheep RBC was significantly ($P < 0.05$) lower in group I (control) than that of other two turmeric fed groups (Table 3).

**Table 1**. Ingredient (%) and chemical composition (% DM basis) of broiler starter and finisher diets

| Parameter | Starter | Finisher |
|---|---|---|
| **Ingredient** | | |
| Maize | 52.0 | 59.00 |
| Soya bean meal | 41.0 | 33.00 |
| DORB | 4.0 | 5.00 |
| Mineral mixture | 2.70 | 2.70 |
| Common salt | 0.30 | 0.30 |
| Chemical composition | | |
| Moisture | 9.74 | 10.10 |
| CP | 22.75 | 20.09 |
| Ether extract | 2.10 | 2.17 |
| Crude fibre | 4.20 | 3.93 |
| Total ash | 9.40 | 9.55 |
| Acid insoluble ash | 2.50 | 2.67 |
| Nitrogen free extract | 61.55 | 64.26 |
| Metabolisable energy*(kcal/kg) | 2790 | 2895 |

All diets were supplemented with common salt @ 0.3%, Lysine 0.1%, DL-methionine 0.1%, toxin binder 0.2%, Trace minerals 0.2%, Bioblend™ 0.01%, Ventriplus™ 0.25%, Veldot™ 0.5%, Biochol™ 0.5%; **Calculated

**Table 2.** Effect of Turmeric supplementation on Antioxidant enzyme status of broiler birds

| Parameters | Group | | | P Value |
|---|---|---|---|---|
| | I | II | III | |
| SOD* (U/mg Hb) | $15.10^{a}$ ±0.61 | $18.77^{b}$ ±0.75 | $18.75^{ab}$ ±0.53 | 0.022 |
| LPO** (µmol MDA formed / mg Hb) | $3.38^{a}$±0.18 | $2.16^{b}$±0.12 | $2.19^{b}$±0.10 | 0.035 |
| Catalase (U/mg Hb) | $2.06^{a}$±0.34 | $3.59^{ab}$±0.29 | $3.65^{ab}$±0.18 | 0.027 |

[ab]Means bearing different superscripts in the same row differ significantly (P<0.05); *SOD: Superoxide dismutase, **LPO: Lipid peroxidation

**Table 3.** Immunity profile of broiler birds under study

| Parameters | Group | | | P value |
|---|---|---|---|---|
| | I | II | III | |
| CBH* | $131.10^{a}$ ± 8.03 | $172.51^{b}$ ± 6.76 | $222.10^{c}$ ± 6.90 | 0.010 |
| SRBC** | $3.90^{a}$ ± 0.20 | $5.39^{b}$ ± 0.18 | $6.14^{c}$ ± 0.12 | 0.034 |

[abc] Values with different superscripts in a row differ significantly; * CBH: Cutaneous basophilic hypersensitivity, **SRBC: Sheep RBC

# Discussion

Turmeric powder enhanced the antioxidant status of heat stressed broilers via improving the activity of glutathione peroxidase and superoxide dismutase and decreasing the concentration of MDA (Zeinali *et al.,* 2011). Similarly Akbarian *et al.* (2015) reported that dietary supplementation with turmeric oil at 200 or 400 mg/kg for 38 days significantly increased erythrocyte CAT and SOD activities in chickens. The beneficial effect on the antioxidant system of the chicken by turmeric is most likely attributed to the phenolic compounds, mainly curcumin and xanthorrhizol (Rukayadi and Hwang 2013). It has also been suggested that phenolic compounds can support antioxidant system possibly through the direct scavenging of free radicals or prevent the formation of free radicals by inhibiting enzymes (Thring *et al.,* 2011).

Supplementation of turmeric enhanced immune status of broiler birds. Similarly Kurkure *et al.* (2000) reported that dietary supplementation of 0.5 g/kg turmeric ameliorated the harmful effect of aflatoxin B1 on the body immune system, showing the humoral immune stimulatory potential in poultry. Churchill *et al.* (2000) showed that curcumin treatment increased the number of T and B cells, suggesting that curcumin modulates lymphocyte-mediated immune functions. Emadi and Kermanshahi (2007) found increased IgA, IgM and IgG concentration in chickens fed with turmeric powder at the level of 0.25%, 0.50% and 0.75% in the ration for 21 days. Similarly Yarru *et al.* (2009) showed that 5.0 g/kg turmeric meal supplementation had beneficial effects on the stimulation of genes expression that involved in antioxidant and immune function in broiler chickens.

**Conclusion**

Supplementation of either 0.5% or 1.0% turmeric powder improved the immunity and antioxidant enzymes concentration of broiler chickens.

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