The Haryana Veterinarian (December, 2024) **63(2),** 187-190 ISSN 0033-4359 (P) **Research Article**

AMELIORATIVE EFFECT OF CURCUMIN SUPPLEMENTATION ON HAEMATOLOGICAL CHANGES IN MONOCROTOPHOS INTOXICATED BROILER CHICKEN

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Received: 14.06.2023; Accepted: 05.08.2023

ABSTRACT

The present experimental study was conducted to assess the ameliorating effect of curcumin supplementation on haematological changes in monocrotophos intoxicated broiler chicken. A total of 132 broiler chicks at the age of 7 days were divided randomly into two groups (group A and B) of 66 chicks in each group. All the chicks of group A were given feed supplemented with curcumin (@ 200 mg/kg of feed) throughout the experiment. All the chicks of group B were given normal feed without any supplementation. At the age of 14 days, the chicks of groups A and B were divided into two subgroups (group A in to A_1 and A_2, group B into B_1 and B_2) of 33 chicks each. All the chicks of group A_1 and B_1 were given monocrotophos @ 5 ppm per kg of feed up to the end of experiment. The chicks of group B_2 served as normal control group i.e. without any curcumin and monocrotophos. Blood samples were collected from six chicks of each subgroup directly from heart on 0, 7th, 14th, 21st and 28th day post initiation of monocrotophos feeding in sterile ethylene diamine tetra acetate (EDTA) coated vials for assessment of haematological parameters. Monocrotophos intoxicated groups (A_1 and B_1) exhibited a significant decrease in both mean haemoglobin and mean total erythrocyte count (TEC) values as compared to control group B_2. Significant increase in mean percent packed cell volume (PCV) values was observed in both the monocrotophos administered groups (A_1 and B_1) as compared to control group B_2. Mean corpuscular volume (MCV) and Mean corpuscular haemoglobin concentration (MCHC) values calculated from the values of Hb, TEC and PCV showed that there was macrocytic hypochromic anaemia in monocrotophos intoxicated chicks which was more severe in group B_1 as compared to group A_1. From the findings of the present study it is concluded that curcumin supplementation (@ 200 mg/kg feed) in monocrotophos administered (@ 5 ppm/kg in feed) broiler chicken showed significant improvement in different haematological alterations showing its ameliorative effect.

Keywords: Broiler chicken, Curcumin, Haematological changes, Macrocytic hypochromic anaemia, Monocrotophos

How to cite: Chahal, A., Nehra, V., Nehra, N. and Lather, D. (2024). Ameliorative effect of curcumin supplementation on haematological changes in monocrotophos intoxicated broiler chicken. *The Haryana Veterinarian* **63(2)**: 187-190.

Poultry is one of the most important and rapidly expanding agricultural industries in India today. Intensively growing poultry industry is also at risk of predisposition to various diseases and toxicities which may lead to great losses. Out of these toxicities, pesticide toxicities are common causes of health consequences to poultry culminating in great economic losses also posing a potential threat to public health due to the presence of pesticide residues in poultry eggs and meat. Monocrotophos, an organophosphorus insecticide and acaricide is extremely toxic to birds and is used as a bird poison (Smith, 1993). Pesticide application can inadvertently affect non-target species, including domestic and wild animals, in addition to the intended pest species (Narang *et al.*, 2016). Its unrelenting use in agriculture has been contaminating surface and ground water, causing neurotoxicity, genotoxicity, hyperglycemia and stressogenic effects in many species (Kaur and Goyal, 2019). This pesticide primarily inhibits the activity of acetyl cholinesterase enzyme and increases the oxidative stress that ultimately results in neurotoxicity. A dietary supplementation of natural antioxidants is necessary to prevent effects of monocrotophos toxicity. Curcumin is derived from the plant *Curcuma longa*, popularly known as turmeric (Kocaadam and Sanlier, 2017). It is an Asian native plant whose rhizome is used as a colour and a culinary condiment because it neutralizes free radicals and protects cells from lipid peroxidation (Khan *et al.*, 2014). Curcumin/turmeric is known to have pharmacological benefits on people, animals and poultry these benefits are anti-inflammatory, antioxidant, antivenom, antimicrobial, antiproliferative, gastroprotective, antiarthritic, neuro-protective well-being, antiangiogenic, antiprotozoal, antimicrobial and anti-cancer effects whether taken orally or topically (Sharma *et al.*, 2005; Lagana *et al.*, 2019). However, there is paucity of data related to ameliorating effect of curcumin in monocrotophos induced toxicity in poultry birds. Hence, the present experimental study was planned to investigate the ameliorating effect of curcumin on monocrotophos induced haematological changes in broiler chicken.

MATERIALS AND METHODS

The present study was conducted in broiler chicks procured from local commercial hatchery and were reared in the departmental animal house under strict hygienic conditions. All the chicks were provided with fresh, clean drinking water and fed ad libitum throughout the experiment. Commercially available chicken starter feed

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was used as it supplies the correct balance of protein, vitamins and minerals necessary for the bird's health. These chicks were vaccinated with Newcastle disease vaccine (NCDV) at the age of 7 days via intranasal route. The chicks were kept in well ventilated rooms maintained at optimum temperature. The experiment was undertaken after taking prior permission from the Institutional Animal Ethics Committee (IAEC) (Permission given in the 23rd IAEC meeting and proceedings of the same circulated vide memo no. VCC/IAEC/2022/1624-51 held on 12.04.2022).

Chemical used: Monocrotophos (MCP) procured from Sigma Aldrich was used in the present study. It was administered orally @ 5 ppm in feed [as used earlier by Babulal (2007) in his experiments].

Curcumin (the active ingredient of turmeric i.e. *Curcuma longa*) used in the present study was procured from Sigma-Aldrich. Curcumin was fed orally along with feed @ 200 mg/ Kg of feed [as used earlier by Canales-Aguirre *et al.* (2012) and Yadav *et al.* (2020) in their experiments].

Experimental design: One hundred and thirty-two (132) chicks at the age of 7 days were divided randomly into two groups (group A and B) of 66 chicks in each group. All the chicks of group A were given feed supplemented with curcumin (@ 200 mg/kg of feed) throughout the experiment. All the chicks of group B were given normal feed without any supplementation. At the age of 14 days, the chicks of groups A and B were divided into two subgroups (group A into A_1 and A_2, group B into B_1 and B_2) of 33 chicks each. All the chicks of group A_1 and B_1 were given monocrotophos @ 5 ppm [as used earlier by Babulal (2007) in his experiments] in per kg feed up to the end of experiment. The chicks of group B_2 served as normal control group i.e. without any curcumin and monocrotophos.

Estimation of haematological parameters: Blood samples were collected from six chicks of each subgroup directly from heart on 0, 7th, 14th, 21st and 28th day post initiation of monocrotophos feeding in sterile ethylene diamine tetra acetate (EDTA) coated vials for assessment of haematological parameters i.e. Hb, TEC, PCV by using Automatic Haematological Analyzer. From the values of Hb, TEC, PCV haematological indices particularly MCV and MCHC were calculated.

Statistical analysis: The data for various parameters were subjected to statistical analysis by using Duncan Multiple Range Test at 5.0% level of significance using SPSS 17.0 version software. Individual means were compared for statistical significance using the least significance difference.

RESULTS AND DISCUSSION

The mean values of haemoglobin concentration and total erythrocyte count were significantly ($P \leq 0.05$) lower in both the monocrotophos administered groups (A_1 and B_1) as compared to control group (B_2) from 21 days post monocrotophos administration. More or less similar results have been reported due to monocrotophos toxicity by various workers (Siddiqui *et al.*, 1991; Gupta *et al.*, 2008; Kant *et al.*, 2018). Haemolysis caused by monocrotophos may be a credible cause of reduced haemoglobin and total erythrocyte count (Singh *et al.*, 2004). However significant ($P \leq 0.05$) improvement in haemoglobin concentration was observed in the curcumin supplemented group (A_1) chicks as compared to group B_1 from 21 DPMA onwards. Kumar (2014) revealed in his studies that there was significant increase in haemoglobin concentration after turmeric supplementation in post kidding goats. In curcumin supplemented group (A_2) the haemoglobin concentration and total erythrocyte count were comparable to the control group (B_2) as there was no significant change noticed (Table 1 and 2).

Significant increase in mean percent packed cell volume(PCV) valueswasobservedinboththe monocrotophos administered groups (A_1 and B_1) as compared to control group B_2 (Table 3). Similar findings were reported by Sunmonu and Oloyede (2010) in rats and Gupta *et al.* (2008) in chicken. The significant increase in Packed Cell Volume (PCV) after administration of Monocrotophos in broiler chickens can be attributed to a combination of factors, including haemolysis, dehydration, stress response, inhibition of acetylcholinesterase, and a direct effect on erythropoiesis. Monocrotophos causes red blood cell damage, leading to haemolysis, and dehydration, resulting in a decrease in plasma volume. Additionally, it triggers a stress response, releasing stress hormones that constrict blood vessels, and inhibits acetylcholinesterase, leading to increased acetylcholine levels that also constrict blood vessels. These factors contribute to an increase in PCV, as the concentration of red blood cells in the blood rises.

Mean corpuscular volume (MCV) and mean corpuscular haemoglobin concentration (MCHC) values were calculated from the values of Hb, TEC and PCV. MCV values were significantly ($P \leq 0.05$) higher in both the monocrotophos administered groups (A_1 and B_1) as compared to control group (B_2) from 21 DPMA onwards. There was significant ($P \leq 0.05$) decrease in MCV in group A_1 as compared to group B_1 from 14 DPMA onwards. The MCV values were comparable in groupsA_2 and B_2 throughout the experiment (Table 4).

The values of percent MCHC were found to be

Table 1. Haemoglobin concentration (g/dl, mean ± S.E.) of broiler chicks in different experimental groups

Groups	Day post monocrotophos administration (DPMA)				
	0 DPMA	7 DPMA	14 DPMA	21 DPMA	28 DPMA
A_1 (MCP+CUR)	9.05^{a}±0.09	9.17^{a}±0.17	8.75^{a}±0.21	8.48^{b}±0.22	8.60^{b}±0.16
A_2 (CUR)	8.90^{a}±0.15	9.38^{a}±0.20	9.48^{b}±0.27	9.18^{bc}±0.17	9.35^{b}±0.33
B_1 (MCP)	8.82^{a}±0.14	8.90^{a}±0.26	8.50^{a}±0.13	6.32^{a}±0.33	6.37^{a}±0.22
B_2 (C)	9.05^{a}±0.08	9.30^{a}±0.14	9.10^{ab}±0.16	9.30^{c}±0.3	8.98^{bc}±0.15

a, b, c: Means with unlike superscript in the column differ significantly (P ≥ 0.05)
Here in table MCP means-Monocrotophos; CUR means- Curcumin; C means- Control

Table 2. Total erythrocyte count (106/µl, mean ± S.E.) of broiler chicks in different experimental groups

Groups	Day post monocrotophos administration (DPMA)				
	0 DPMA	7 DPMA	14 DPMA	21 DPMA	28 DPMA
A_1 (MCP+CUR)	2.27^{a}±0.04	2.30^{a}±0.15	2.33^{b}±0.05	2.09^{a}±0.16	1.92^{b}±0.18
A_2 (CUR)	2.29^{a}±0.02	2.47^{a}±0.09	2.41^{b}±0.04	2.54^{b}±0.08	2.90^{c}±0.14
B_1 (MCP)	2.33^{a}±0.08	2.31^{a}±0.08	2.10^{a}±0.12	1.83^{a}±0.09	1.48^{a}±0.05
B_2 (C)	2.30^{a}±0.06	2.21^{a}±0.09	2.45^{b}±0.03	2.52^{b}±0.08	2.72^{c}±0.06

a, b, c: Means with unlike superscript in the column differ significantly (P ≥ 0.05)
Here in table MCP means-Monocrotophos; CUR means- Curcumin; C means- Control

Table 3. Packed cell volume (%, mean ± S.E.) of broiler chicks in different experimental groups

Groups	Day post monocrotophos administration (DPMA)				
	0 DPMA	7 DPMA	14 DPMA	21 DPMA	28 DPMA
A_1 (MCP+CUR)	29.87^{a}±0.47	30.37 a ±0.63	30.90 a ±0.6	30.91^{ab}±0.55	31.28^{ab}±0.81
A_2 (CUR)	30.17^{a} ±0.3	30.13^{a} ±0.46	29.90^{a} ±0.4	29.87^{a} ±0.58	29.85^{a} ±0.35
B_1 (MCP)	30.03^{a} ±0.29	30.73^{a} ±0.44	31.27^{a} ±0.86	32.02^{b}±0.66	32.57^{b}±0.37
B_2 (C)	30.15^{a} ±0.23	29.7^{a} ±0.77	29.75^{a} ±0.44	30.06^{a} ±0.15	30.19^{a} ±0.59

a, b, c: Means with unlike superscript in the column differ significantly (P ≥ 0.05)
Here in table MCP means- Monocrotophos; CUR means- Curcumin; C means- Control

Table 4. Mean corpuscularvolume (femto litres, mean± S.E.) of broiler chicks in different experimental groups

Groups	Day post monocrotophos administration (DPMA)				
	0 DPMA	7 DPMA	14 DPMA	21 DPMA	28 DPMA
A_1 (MCP+CUR)	131.88^{a}±3.98	134.43^{a}±8.23	132.76^{a}±2.85	152.58^{b}±12.47	168.70^{b}±12.76
A_2 (CUR)	131.96^{a}±1.51	122.88^{a}±5.21	124.37^{a}±2.12	118.02^{a}±3.31	104.37^{a}±6.37
B_1 (MCP)	129.67^{a}±3.58	134.28^{a}±5.98	151.07^{b}±8.73	177.40^{c}±9.72	221.88^{c}±7.56
B_2 (C)	131.51^{a}±3.41	135.42^{a}±6.51	121.47^{a}±1.88	119.93^{a}±3.78	111.21^{a}±1.96

a, b, c: Means with unlike superscript in the column differ significantly (P ≥ 0.05)
Here in table MCP means- Monocrotophos; CUR means- Curcumin; C means- Control

significantly (P≤0.05) lower in both the monocrotophos administered groups (A_1 and B_1) as compared to control group (B_2) from 14 DPMA onwards in group B_1 and only on 21 DPMA in group A_1. There was significant (P≤0.05) improvement percent MCHC values in group A_1 as compared to group B_1 from 21 DPMA onwards. The values of percent MCHC were comparable in groups A_2 and B_2 throughout the experiment (Table 5). These findings revealed that there was macrocytic hypochromic anaemia in monocrotophos intoxicated chicks which was more severe in group B_1 as compared to group A_1. The decrease in Hb and TEC concentrations due to monocrotophos intoxication might be due to haemorrhages observed in the present study, responsible for hypochromic anaemia. Regarding, macrocytic anemia, it might be due to severe diarrhea causing dehydration resulting in hemoconcentration

Table 5. Mean corpuscular haemoglobin concentration (%, mean±S.E.) of broiler chicks in different experimental groups

Groups	Day post monocrotophos administration (DPMA)				
	0 DPMA	7 DPMA	14 DPMA	21 DPMA	28 DPMA
A_1 (MCP+CUR)	30.35^{a}±0.63	30.23^{a}±0.62	28.36^{ab}±0.82	27.46^{b}±0.61	27.58^{b}±0.87
A_2 (CUR)	29.53^{a}±0.74	31.20^{a}±0.98	31.78^{c}±1.18	30.78^{c}±0.65	31.30^{c}±1.35
B_1 (MCP)	29.36^{a}±0.4	28.96^{a}±0.75	27.27^{a}±0.69	19.80^{a}±1.26	19.53^{a}±0.48
B_2 (C)	30.02^{a}±0.03	31.42^{a}±0.98	30.60^{bc}±0.48	30.96^{c}±1.09	29.78^{bc}±0.31

a, b, c: Means with unlike superscript in the column differ significantly ($P \geq 0.05$)
Here in table MCP means- Monocrotophos; CUR means- Curcumin; C means- Control

(Benjamin, 1978; Sastry, 1983) in monocrotophos toxicity groups. Schalm *et al.* (1986) also described that there is increase in PCV due to the release of erythrocytes from body reservoir and shrinkage of plasma volume as a result of dehydration. The decrease in hematological parameters in monocrotophos toxicity could be due to the decrease in hemoglobin contents which results from the impairment of biosynthesis of heme in bone marrow as reported by Shakoori *et al.* (1992) in his studies on effect of prolonged administration of insecticide (cyhalothrin karate) on the blood and liver of rabbits.

CONCLUSION

The results of the present study elucidated that curcumin supplementation (@ 200 mg/kg feed) in monocrotophos administered (@ 5 ppm/kg in feed) broiler chicken showed significant improvement in different haematological alterations showing its ameliorative effect.

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