EFFECT OF ENROFLOXACIN ADMINISTRATION ON HAEMATOLOGICAL PROFILE IN BROILER CHICKEN- A SAFETY PHARMACOLOGY STUDY

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ABSTRACT

A safety pharmacological trial was conducted to investigate the effect of enrofloxacin on haematological profile after pulsed water medication in broiler chicken, at therapeutic dose 10 mg/ kg body weight through drinking water for five consecutive days in accordance with the FDA approved norms. There was no significant ($p>0.05$) changes in haemtological parameters except significant ($p>0.05$) elevation of heterophils on 1st and 3rd day of post treatment and a significant ($p>0.05$) decrease in lymphocyte count . The results of the present study suggest that the reduction in the lymphocyte count at therapeutic dose of enrofloxacin may have influence on the immune response of the birds.

KEY WORDS: Enrofloxacin, Ciprofloxacin, Safety pharmacology, Haematological profile.

INTRODUCTION

In the modern intensive husbandry methods of poultry production, antimicrobial agents are being increasingly used to enhance feed efficiency, promote health, improve productivity, for disease prophylaxis and treatment (Prescott et al., 2000). The fluoroquinolones are synthetic antimicrobial agents used widely in veterinary medicine for the control of early mortality and for the prophylaxis and treatment of respiratory, renal and digestive infections of poultry (Martinez et al., 2006). Enrofloxacin is a fluoroquinolone that was developed exclusively for veterinary use and in poultry used in large-scale for treatment of chronic respiratory disease (CRD), Colibacillosis, Salmonellosis and Fowl Cholera (Anderson et al., 2003: Ellakany et al., 2007).

However, information on residual effect of enrofloxacin and post market surveillance on haematologic response of the broiler chicken during the post treatment periods, under controlled experimental conditions are lacking. Hence, a safety pharmacological trial in broiler chicken was conducted to investigate the effect of enrofloxacin on haematological profile after pulsed water medication.

MATERIALS AND METHODS

Thirty six day old broiler chicks (Broiler strain B1) were obtained from Institute of Poultry Production and Management, TANUVAS, Madhavaram Milk Colony, Chennai-600 051, India. Chicks were wing banded and maintained under brooder management for 14 days and on day 15 birds were transferred to cage and maintained under standard management conditions. Necessary approval was obtained from Institutional Animal Ethics Committee (IAEC), Madras Veterinary College, TANUVAS, for conducting the experiment. Non-medicated (free from feed additives, antibiotics and anticoccodials) and residue free (mycotoxins, pesticides, heavy metals and coliform count) broiler feed and drinking water were used throughout the experiment.

Enrofloxacin water medication

Enrofloxacin 10% oral solution was obtained as gratis from M/s. Neospark Drugs and Chemicals Private Limited, Hyderabad, India. Day old broiler chicks were divided randomly into two groups, Group-I Control and Group-II Treatment. Control group (6 birds) received non-medicated water and

Treatment group (30 birds) was administered with enrofloxacin at recommended therapeutic dose 10 mg/kg body weight through drinking water for five consecutive days from 43rd to 47th day of age, in accordance with the Food and Drugs Administration (FDA) approved norms for use of the antimicrobial in poultry (Reyes Herrera et al., 2011). Medicated water was prepared fresh daily. Birds received their daily medication during a 4 hour period in the morning and water was free from antibiotic for the remaining 20 hours of each day. The concentration of enrofloxacin in the water to give the required dose per kilogram of body weight was calculated by determining the water consumption and body weight of each bird on the day of medication (Knoll et al., 1999). Drinking water treatment was used because oral administration of drugs is the most practical way for treating birds being followed in field condition.

Blood samples were drawn from wing vein in sterile heparinised vials from 6 birds from control group - at 43rd day of age and from treatment Group at 24 hours interval during the treatment period for a week post treatment . Blood smears were prepared simultaneously at the time of blood collection and used for differential leukocyte count. Heparinised blood samples were subjected to haematological profile which encompassed estimation of packed cell volume (PCV) by microhaematocrit method, haemoglobin by acid haematin method, total erythrocyte count (RBCs) and total leucocyte count (WBCs) by direct (Haemocytometer) method (Campbell and Coles, 1986).

Data were subjected to one way analysis of variance for their significance as per Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The effect of enrofloxacin on haematological profile (Haemoglobin, PCV, RBCs, WBCs and Differential leukocyte count) were shown in Table 1 and Table 2. The results revealed that there was no significant ($p>0.05$) change in haemoglobin, PCV and RBCs throughout the experiment. Whereas, a transient decrease in WBCs was observed during the treatment period after 4th dose as well as on the 1st day post treatment, which is statistically non significant ($p>0.05$) (Table 1). This is in accordance with the findings of Ellakany et al. (2007) who reported that even 10 times overdose of enrofloxacin (100 mg/kg body weight) had no significant effect on RBCs count or

Table 1: Effect of enrofloxacin on haematological profile in broiler chicken

	Hb (g/dL)	PCV (%)	RBC (10^6/µL)	WBC (10^3/µL)
43rd day of age (Control)	10.48±0.09	32.87±0.20	2.44±0.02	10.87±0.14
44th day of age (after 1st dose)	10.83±0.18	32.83±0.58	2.47±0.05	10.80±0.25
45th day of age (after 2nd dose)	10.58±0.18	33.03±0.13	2.50±0.03	10.78±0.29
46th day of age (after 3rd dose)	10.42±0.18	32.72±0.49	2.50±0.02	10.75±0.21
47th day of age (after 4th dose)	10.58±0.15	33.70±0.40	2.51±0.04	09.78±0.29
48th day of age (1st DPT)	10.88±0.19	33.73±0.26	2.54±0.03	09.73±0.31
50th day of age (3rd DPT)	10.63±0.14	33.40±0.29	2.58±0.06	10.10±0.30
52nd day of age (5th DPT)	10.68±0.10	33.00±0.37	2.59±0.03	10.60±0.22
54th day of age (7th DPT)	10.68±0.12	32.08±0.65	2.58±0.02	10.63±0.35
56th day of age (9th DPT)	10.83±0.16	33.48±0.28	2.57±0.09	10.70±0.40

Values are expressed as Mean±SE, n=6, $p>0.05$.

1st DPT - 1st Day Post Treatment, 3rd DPT - 3rd Day Post Treatment,
5th DPT - 5th Day Post Treatment, 7th DPT - 7th Day Post Treatment,
9th DPT - 9th Day Post Treatment.

haematocrit in the broiler chickens.

However, the heterophils were significantly ($p<0.05$) elevated on 1st day and 3rd day post treatment. Even though there was numerical increase in heterophils from 5th day through 9th day post treatment although statistically non significant ($p>0.05$) compared to that of control (Table 2). These results agree with Fleischer et al. (2000) who mentioned that enrofloxacin treatment increased heterophils. This could be attributed to the inflammatory process in thymus, bursa and spleen. Ellakany et al. (2007) also reported that heterophils were significantly higher in both therapeutic dose (10mg/kg body weight) and over dose (100 mg/kg body weight) of enrofloxacin treated group

Table 2: Effect of enrofloxacin on differential leukocyte count in broiler chicken

	Heterophils (%)	Lymphocytes (%)	Monocytes (%)	Eosinophils (%)	Basophils (%)
43rd day of age (Control)	22.83±0.76^{c}	71.00±0.41^{a}	3.0±0.47	2.17±0.28	1.00±0.33
44th day of age (after 1st dose)	23.17±0.72^{bc}	69.00±0.82^{ab}	3.83±0.37	2.67±0.19	1.33±0.30
45th day of age (after 2nd dose)	24.00±0.75^{bc}	68.67±0.45^{bc}	3.33±0.38	2.50±0.20	1.50±0.20
46th day of age (after 3rd dose)	24.33±0.77^{bc}	68.67±0.84^{bc}	3.33±0.30	2.33±0.19	1.33±0.30
47th day of age (after 4th dose)	24.50±0.70^{abc}	68.17±1.04^{bc}	3.33±0.38	2.83±0.15	1.17±0.28
48th day of age (1st DPT)	26.50±0..57^{a}	66.67±0.61^{c}	3.17±0.55	2.33±0.30	1.33±0.30
50th day of age (3rd DPT)	25.00±0.53^{ab}	67.83±0.50^{bc}	3.33±0.19	2.67±0.19	1.17±0.28
52nd day of age (5th DPT)	24.83±0.55^{abc}	67.67±0.65^{bc}	3.50±0.20	2.67±0.19	1.33±0.30
54th day of age (7th DPT)	24.83±0.80^{abc}	68.00±0.67^{bc}	3.67±0.30	2.33±0.19	1.17±0.28
56th day of age (9th DPT)	23.00±0.71^{bc}	69.00±0.53^{ab}	3.83±0.37	2.83±0.28	1.33±0.30

than the control group.

Values are expressed as Mean±SE, n=6.

Means bearing different superscript within the column differ significantly ($p<0.05$).

1st DPT - 1st Day Post Treatment, 3rd DPT - 3rd Day Post Treatment,

5th DPT - 5th Day Post Treatment, 7th DPT - 7th Day Post Treatment,

9th DPT - 9th Day Post Treatment.

The present study showed a significant ($p<0.05$) decrease in lymphocyte count after 2nd dose, attaining lowest on 1st day post treatment and the effect was sustained even during the post treatment periods. Even though there was significant decrease in lymphocyte during 3rd day post treatment through 9th day post treatment, tendency in approaching control values were noticed. There was no significant ($p>0.05$) change in monocyte, eosinophils and basophils count throughout the experiment (Table 2). These findings are in accordance with Fleischer et al. (2000) who added

that enrofloxacin decreased lymphocytes starting from 17th till 35th day of age when chickens were fed a diet supplemented with enrofloxacin, while increased leukocytic count and neutrophils.

Further, Ali and Jalaa (2005) reported that the haemotological parameters were numerically decreased in comparison with that of the control group but the differences were not significant in enrofloxacin treated chickens. In contrast, Ellakany et al. (2007) showed a significant decrease in lymphocyte, basophils and eosinophils in broilers treated with over dose of enrofloxacin (100 mg/ kg body weight) and mentioned that this may have an effect on the immune response. This may be a reflection for the histopathological alterations in both thymus and bursa of Fabricious which showed dispersion and depletion of the lymphocyte contents with several areas of lymphoblastic degeneration (Ellakany et al., 2007). These changes might be attributed to the inhibition of RNA and protein synthesis by enrofloxacin (David et al., 1988).

Enrofloxacin is metabolised in the liver via de-ethylation into the major metabolite ciprofloxacin (EMEA, 1998: Prescott et al., 2000). It has been reported that after oral administration of enrofloxacin @ 10 mg/kg body weight for 5 consecutive days, the enrofloxacin and its major metabolite ciprofloxacin residues could be detected until 9 days post treatment in both liver and muscle tissues (San Martin et al., 2010). The significant fall in lymphocyte count observed during the treatment period and the sustained effect noticed even during the post treatment period could be attributed to the presence of enrofloxacin and its major metabolite ciprofloxacin residues in the body. Results of the present study suggest that the reduction in the lymphocyte count at therapeutic dose of enrofloxacin even during the post treatment period may have influence on the immune response of the birds.

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