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Haemato-biochemical alteration in chicks (*Gallus domesticus*) following short term exposure of synthetic pyrethroid type II fenvalerate

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Abstract

Sub acute toxicity of oral administration of fenvalerate in chicks was assessed. Birds were divided into four groups, group C1, C2, T1 and T2 with each group containing 25 birds. The birds of group C1 was given no treatment and served as control. Group C2 was administered groundnut oil and served as vehicle. Group T1 and T2 were given 2mg/kg of fenvalerate suspended in groundnut oil for 10 and 15 day. The blood sample were collected from birds after 10^{th} and 15^{th} days of oral administration and analyzed for hematological and biochemical parameters. The study showed that hematological parameter (Hemoglobin, packed cell volume, total erythrocyte count) remained unaffected except total leukocyte count was decreased significantly ($P<0.05$) and Total serum protein was also decreased significantly ($P<0.01$). Fenvalerate induced significant alteration in serum Aspartate aminotransferase ($P<0.01$) and Alanine aminotransferase ($P<0.05$) activity.

Key words: ***Gallus domesticus*, fenvalerate, synthetic pyrethroid, toxicity.**

Introduction

The pyrethroid class of insecticides was derived from natural compounds (the pyrethrum) isolated from the Chrysanthemum genus of plants (Casida 1980). Synthetic pyrethroids are generally referred as safe insecticides due to their low acute toxicity to mammals .Long term exposure to these products causes countless abnormalities and reduces the life span of organisms (Hussain *et al.*, 2011, Naz *et al.*, 2011). Synthetic pyrethroid are designed to be more chemically potent and environmentally stable than natural pyrethrins while still retaining their relatively low mammalian toxicity (Soderlund *et al.*, 2011). In spite of low toxicity of pyrethroid, persistence of these compounds in mammalian tissue may be dangerous (Crawford *et al.*, 1981). Fenvalerate is a potent synthetic pyrethroid that has been in use since long time it is an ester of 2(-4-chlorophenyl)-3-methyl butyric acid and α-cyno -3-phenoxybenzyl alcohol but lacks a cyclopropane ring. The primary mechanism of toxic action of pyrethroid has generally been considered to be interference with the sodium gate in the nerve membrane (Parasanthi *et al.*, 2005 Synthetic pyrethroid another group of insecticides are important because of their outstanding rapid knockdown action on flying insects and to a low mammalian toxicity due to their rapid metabolic conversion to non basic produced (Jacobson and Crosby 1971, WHO, 1990). Synthetic pyrethroid are esters of chrysanthemic acid halo substituted chrysanthemic acid 2-(4-chloophenyl)-3-methyl butyric acid and alcohol (eg. Allethrolene, 3-phenoxy benzyl alcohol) for certain pyrethroid asymmetric centre (s) exist in the acid and / or alcohol moiety and the commercial products sometimes consist of a mixture of both optical (R/S and D/L) & geometric (cis / Trans) isomers.

To combat the problem of insect in food grains and crop initially use of chlorinated hydrocarbons and organophosphate were started due to slow biodegradation of these insecticide, residual may remain on the crop, which if eaten by animals and human beings suffer from many metabolic disorders. In due course of time most of the insecticides were banned and pyrethroid got place to combat the problem of insect in agriculture but the question of toxicity is still burning problem because ultimately pyrethroid are used to kill insect by attacking on other mechanism of central nervous system and respiratory system or any other else.

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Usually, myth prevails in the field more is better hence, there is a tendency to overuse pesticides. Residual effect of insecticides in cow milk has been reported in previous years, pyrethroid being used to kill the insect by spraying on food crops and food grain, its residual effect on agricultural produce and consequently in poultry feed cannot be denied which may cause adverse effect on the health of poultry itself and finally its users. The toxic impact of synthetic pyrethroid is of great interest of the scientist because of their deteriorating action on the biochemical and biophysical set up of the body. Synthetic pyrethroids are being used very commonly due to their excellent insecticidal activity and remarkably low mammalian and avian toxicity.

Material and Methods

One day old chicks were procured from local hatcheries. The chicks were randomly and equally divided in to four groups C1, C2, T1 and T2 of 25 chicks. Birds were kept in cages under standard conditions in experimental house and a floor sufficient space was provided to each chick. Dried paddy straw was provided as a bedding material for chicks. Group C1 served as control group, Group C2 received groundnut oil and served as vehicle. The birds of group T1 and T2 were orally administrated 2mg/kg BW of fenvalerate for 10 and 15 day respectively, experiment set was repeated three times. For estimation of biochemical parameter 6 chicks were selected at random from each group and blood (appox 2ml) was collected from jugular vein in heparinized vials. Blood samples were also analyzed for estimation of hemoglobin, Total erythrocyte count (TEC), Packed cell volume (PCV), Total leucocytes count (TLC) was estimated following method given by Schalm's veterinary heamatology. Aspartate amino transferase (AST), Alanine aminotransferase (ALT) by adopting the method of Bergmeyer (1978), Total protein by modified Dumas and Bi- uret method. The data were analyzed using (student t- test) SPSS 15 and (Data expressed Mean±S.D.) statistical significance was ascribed at $P<0.01$ and $P<0.05$.

Result and Discussion

The present study was conducted to see the effect of fenvalerate on hematobiochemical profile of chicks. The administration of fenvalerate did not create any significant change in the level of Haemoglobin (Hb), Packed cell volume (PCV), and Total erythrocyte count (TEC) (fig 1.1and table 1) however, after 10 day of exposure there was statistical significant reduction $P<0.05$in Total leucocyte count (TLC). Similar with present study no change was observed in hemoglobin and PCV with the administration of different insecticide in chicks (Mohiuddin and Ahmed, 1986, Thaker and Garg 1993). Thaker (1988) did not observed any significant alteration in hemoglobin, PCV, and TEC in WHL chicks by long term daily oral administration of endosulfan and malathion. Garg *et al.*, 2004 also found no change in erythrocyte count, packed cell volume, haemoglobine after feeding 20 ppm fenvalerate, 2ppm monocrotophos, 2ppm endosulphan in broiler chicks. Fenvalerate induced significant changes total leukocyte count. Leukocytes are an important component of cellular defense in the body . A significant decrease in total leukocyte count in fenvalerate treated chickens could adversely affect cellular and humoral defense of the body. Significant ($p<0.01$) reduction in total protein was observed in fenvalerate treated birds, which agreed with the findings of earlier workers in T-2 toxin feed birds also show reduction in protein content (Kamalavenkatesh 2003). Protein plays an important role in the life of all living organisms. Saravanan and Harikrishna, 1998, also suggest that depletion of protein could be due to the mobilization of protein to meet the impending energy demands when the animal was under stress.
The statistical increase ($P<0.01$and $P<0.05$) Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) values might be attributed to the liver damage in the toxin fed birds. Damage to liver is known to result in cellular change in the tissues and alteration in activities of enzymes in liver and serum (Zimmerman1990). Aminotransferases (AST and ALT) are the first enzyme to be used in diagnostic enzymology when liver damage has occurred (Kuchel and Raltson 1988.), because of their intracellular location in the cytosol, toxicity affecting the liver with subsequent break down in membrane architecture of the cells leads to their spillage in to plasma and this increase in AST and ALT activity may be due to increased

Table: 1 Effect of daily oral administration of fenvalerate on hemato-biochemical parameters in chicks (*Gallus domesticus)*

Parameters	Group C1	Group C2	Group T1	Group T2
Hemoglobin(Hb)%	9.97±0.2	9.75±0.3	9.01±0.7	8.78±0.9
Packed cell volume (PCV)	30.00±1.2	29.43±1.1	28.11±0.4	27.52±0.3
Total Erythrocyte count(TEC)$10_{6/MM3}$	2.60±0.6	2.62±0.8	2.43±0.3	2.41±0.1
Total leucocye count (TLC)(no.MM_3)	12355.6±333.1	12345.1±123.2	11793.31±117.5[b]	10253.60±632.4[b]
Aspartat aminotransfease(AST) (IU/L)	178.53±2.31	180.1±1.21	211.14±0.22[a]	245.19±1.16[a]
Alanine aminotransferase(ALT)(IU/L)	9.5±0.07	9.7±0.03	12.01±0.41[b]	13.02±0.21[a]
Total protein (g/dl)	3.58±0.2	3.61±0.5	2.26±0.3[a]	2.14±0.4[a]

Mean ± standard error (n = 6)
(a,b)level of significance P<0.01,P<0.05

Fig 1.1 Showing hematological changes due to exposure of fenvalerate in different experimental groups

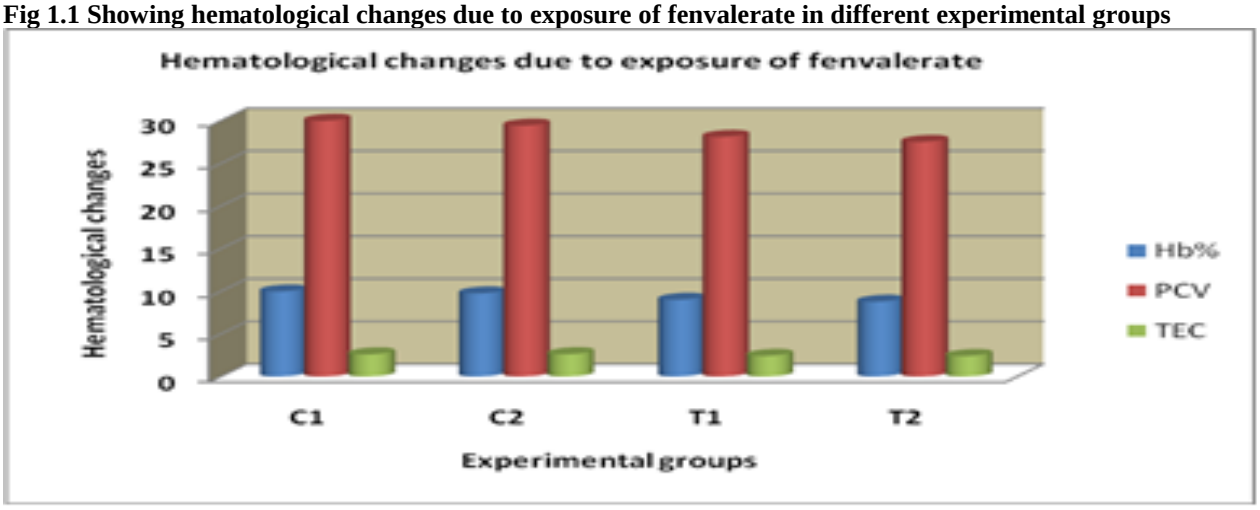
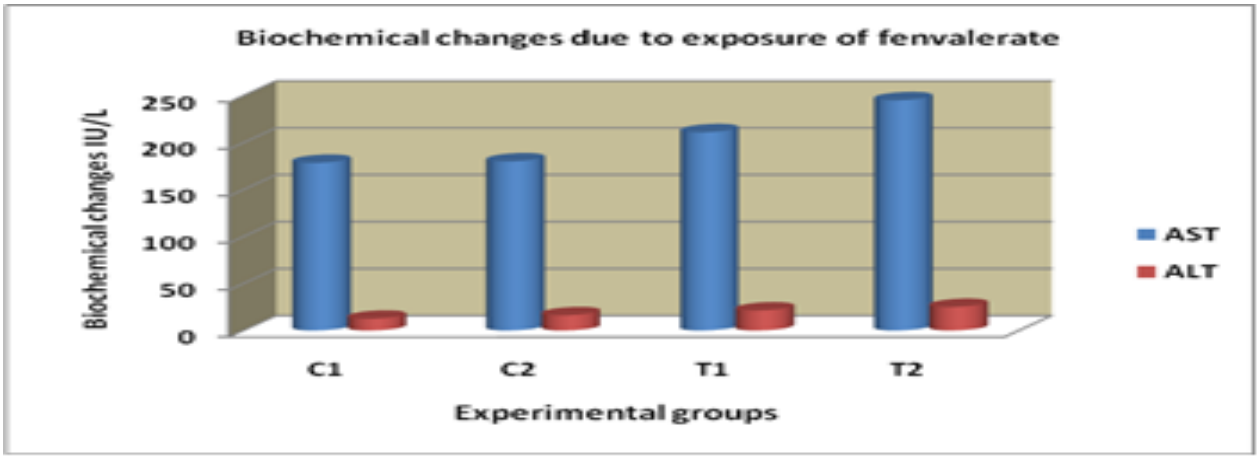


Fig 1.2 Showing biochemical changes due to exposure of fenvalerate in different experimental groups



transamination for rapid breakdown of carbohydrates and proteins to compensate the increased energy crisis resulting from fenvalerate intoxication. The increased transaminase activity may be associated with the rapid utilization of reserved food material, i.e. carbohydrates and proteins. Thus decrease in the protein content $P<0.01$ in fenvalerate stressed chicks observed during this study may be associated with the increased transaminase activity.

Conclusion

India is developing country day by day requirement of food increases and to cope up the demand farmers use more and more pesticides and fertilizers. The effect of such toxin material cannot be denied like there bioaccumulation and bio remediation direct or indirect. Poultry is main component of large population and exposure of such chemical may produce harm to the biological setup of human beings. There must be some monitoring agency for the use of pesticides and fertilizer to prevent such contamination in food chain.

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