EFFECT OF PESTICIDE RESIDUE ON THE HAEMATOLOGICAL PICTURE OF BROILERS FED DIFFERENT LEVELS OF CRUDE PROTEIN

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A study involving 240 broiler chicks was conducted to observe the influence of different levels of pesticide (Lannate) and protein on the haematological picture of the chicks. The results indicated significant decrease in erythrocytic count, haemoglobin contents and packed cell volume but significant increase in erythrocyte sedimentation rate and total leukocyte count due to levels of pesticide at the end of 4, 6 and 8 weeks of age. These parameters were not influenced by the levels of protein except that total leukocytic count at the end of 4 weeks was significantly reduced at lower protein level.

INTRODUCTION

It is reported that huge quantities of different insecticides and pesticides are being used in spraying wheat, cotton, maize and rice crops. The toxic effects of these pesticides may lead to cause hydropericardium and ascites in broilers resulting in "Hydropericardium like syndrome" which has recently emerged as a havoc for poultry farmers (Qureshi, 1989).

These pesticides and insecticides are also reported to affect the haematological values of the Japanese quails when ingested through diet (Ernst and Ringer, 1968). It has been reported that haemoglobin content in blood of Japanese quail decreases after the oral ethylene dibromide treatment at the rate of 65 mg/kg body weight (Westlake *et al.*, 1980). Mohiuddin and Ahmad (1986) fed five White Leghorn cockerels with Ekalux pesticide at the rate of 5 mg/bird/day for 20 days and observed significant reduction in total erythrocytes. Similarly, Itturi (1974) observed that continuous administration of DDT (200 ppm) in the feed of adult hens reduced packed cell volume and haemoglobin concentration in the blood. The present study was, therefore, undertaken to investigate haematological picture of broiler chicks as influenced by different levels of protein and pesticide (Lannate).

MATERIALS AND METHODS

The experiment was conducted on 240 day-old commercial broilers at Poultry Research Centre, University of Agriculture, Faisalabad for 8 weeks in a completely randomized design with 2 x 4 factorial arrangement. Two rations A and B were prepared. Ration A had 23% crude protein (CP) and 3000 Kcal/kg metabolizable energy (ME) during starter phase and 19% CP with 3200 Kcal/kg ME during finisher phase. Ration B was formulated so as to contain 20% CP and 3000 Kcal/kg ME for starter phase and 20% CP with 3200 Kcal/kg ME for finisher phase. Four levels of pesticide i.e. T0, T1, T2 and T3 were maintained by mixing it in the rations at the rate of 0, 50, 100 and 150 parts per million (ppm), respectively. In this way, 8 rations AT0, AT1, AT2, AT3, BT0, BT1, BT2, and BT3 were formulated. Starter rations were fed to experimental birds upto 28 days of

age and after that finisher rations were offered till the end of the experiment *ad libitum*.

At the end of 4, 6 and 8 weeks, blood was collected in test tubes containing ethylene diamine tetra-acetic acid (EDTA) as anticoagulant from one bird of each experimental unit (3 from each treatment).

The estimates were made for erythrocyte count (with Neubauer Chamber), haemoglobin contents (Sahli's method), packed cell volume (Capillary method), erythrocyte sedimentation rate (Westergren tube method) and total leukocytic count (Neubauer chamber) as described by Benjamin (1978).

The data thus collected on all these parameters were analysed, using analysis of variance technique and significant differences among treatment means were compared by Duncan's Multiple Range test (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

1. Erythrocyte count: Erythrocytic count increased with the advancement of age of chicks in all the groups, however, these values were relatively lower in birds fed on Lannate, particularly at higher rates (Table 1). Analysis of variance of the data showed a highly significant difference in erythrocytic count of different age groups at 4, 6 and 8 weeks of age. The levels of protein, however, showed non-significant difference. The protein and pesticide interaction was also non-significant (Table 2).

The comparison of means at 4, 6 and 8 weeks of age showed significant reduction in erythrocytic count of the birds fed different levels of pesticide as compared to those given feed without pesticide. These values at 4 weeks showed non-significant differences among 50,100 and 150 ppm pesticide levels in feed. At 6 weeks of age the pesticide at 100 and 150 ppm level, however, showed a significant decrease in erythrocytes as compared to 50 ppm level. At 8 weeks of age the differences among the pesticide given groups were non-significant, except between 50 and 150 ppm level.

The results of present study are in line with those of Ernst and Ringer (1968). The decrease in erythrocytic values, with addition of pesticide was possibly due to liver damage that disturbed the availability of iron and vitamin B12 which are considered to be essential for the production of erythrocytes.

2. Haemoglobin (Hb) contents: The Hb contents showed a decline at the age of 6 weeks but substantially increased at 8 weeks relative to the values at 4 weeks in all the groups (Table 1). These values were apparently found to be relatively low in the pesticide fed groups at all ages. Analysis of variance of the data revealed significant differences in Hb contents at 4, 6 and 8 weeks of age due to levels of pesticide (Table 2). The levels of protein, however, showed a non-significant difference. The protein and pesticide interaction was also non-significant.

The comparison of means indicated that Hb contents at 4 weeks of age significantly reduced only at 100 and 150 ppm pesticide levels in comparison to control group; the difference between rations containing 50 ppm and no pesticide as well as among those containing 50, 100 and 150 ppm levels were non-significant. The Hb contents reduced significantly at 6 weeks of age in all the pesticide fed groups as compared to control group; the differences among the former groups were non-significant except between the lower and higher pesticide level. The results at 8 weeks of age indicated that all the pesticide levels were significantly different from one another and showed significantly lower Hb contents in comparison to the group fed ration without pesticide.

Table 1. Mean haematological values of the experimental birds at various ages fed on various levels of pesticide and protein

Parameter	Pesticide level	4 weeks			6 weeks			8 weeks		
		A	B	Mean	A	B	Mean	A	B	Mean
Erythrocyte count (million/mm^3)	T0	2.45	2.38	2.41 a	2.61	2.59	2.60 a	3.44	3.43	3.44 a
	T1	2.18	2.15	2.17 b	2.40	2.38	2.39 b	3.16	3.15	3.16 b
	T2	2.18	2.12	2.15 b	2.30	2.28	2.29 c	3.14	3.14	3.14 bc
	T3	2.15	2.10	2.12 b	2.26	2.30	2.28 c	3.11	3.10	3.11 c
	Mean	2.24	2.19	2.21	2.39	2.39	2.39	3.21	3.21	3.21
Hb (g/dl)	T0	9.30	9.10	9.20 a	8.50	8.40	8.45 a	11.50	11.43	11.47 a
	T1	8.60	8.50	8.55 ab	7.40	7.20	7.30 b	10.30	10.33	10.32 b
	T2	8.50	8.30	8.40 b	7.30	7.07	7.18 bc	10.00	9.93	9.97 c
	T3	8.40	8.10	8.25 b	7.03	6.90	6.97 c	9.60	9.63	9.62 d
	Mean	8.70	8.50	8.60	7.56	7.39	7.47	10.35	10.33	10.34
PCV (%)	T0	30.17	30.00	30.08 a	30.33	29.00	29.67 a	32.50	32.00	32.25 a
	T1	26.00	26.00	26.00 b	26.00	26.50	26.25 b	27.83	27.58	27.71 b
	T2	25.67	25.50	25.58 b	26.00	25.83	25.92 b	26.33	26.00	26.17 c
	T3	25.33	25.33	25.33 b	24.33	25.00	24.67 b	25.17	24.83	25.00 d
	Mean	26.79	26.71	26.75	26.67	26.58	26.62	27.96	27.60	27.78
ESR (mm/hour)	T0	3.50	3.67	3.58 b	3.67	3.50	3.58 b	2.83	3.00	2.92 c
	T1	4.67	4.33	4.50 ab	4.00	4.17	4.08 b	4.00	4.17	4.08 b
	T2	5.00	5.00	5.00 a	4.67	5.00	4.83 a	4.58	4.67	4.62 ab
	T3	5.50	5.50	5.50 a	4.67	4.67	4.67 a	4.83	4.92	4.87 a
	Mean	4.67	4.62	4.65	4.25	4.33	4.29	4.06	4.19	4.12
TLC (Thousand/mm^3)	T0	16.32	16.13	16.22 d	16.77	16.45	16.61 c	17.92	17.52	17.72 c
	T1	18.28	17.79	18.03 c	18.45	18.17	18.31 b	19.73	20.10	19.92 b
	T2	19.21	18.21	18.71 b	18.85	18.92	18.89 ab	20.60	21.00	20.80 a
	T3	19.74	19.07	19.40 a	19.18	19.21	19.19 a	21.05	21.20	21.12 a
	Mean	18.39 e	17.80 f	18.09	18.31	18.19	18.25	19.82	19.95	19.89

Means followed by different letters for a particular parameter and specific age show significant difference.

Table 2. Analysis of variance of the data on haematological values of experimental birds

Parameters	Source of variation	Degree of freedom	Mean squares		
			4 weeks	6 weeks	8 weeks
Erythrocyte count	Prot. @	1	0.017NS	0.001NS	0.0001NS
	Pest. #	3	0.109**	0.132**	0.139**
	Prot. x Pest.	3	0.0003NS	0.001NS	0.00005NS
	Error	16	0.005	0.002	0.001
Hb	Prot.	1	0.240NS	0.167NS	0.002NS
	Pest.	3	1.050*	2.649**	3.865**
	Prot. x Pest.	3	0.010NS	0.006NS	0.005NS
	Error	16	0.321	0.066	0.055
PCV	Prot.	1	0.042NS	0.042NS	0.753NS
	Pest.	3	30.083**	27.458**	60.635**
	Prot. x Pest.	3	0.014NS	1.236NS	0.016NS
	Error	16	1.729	3.344	0.466
ESR	Prot.	1	0.010NS	0.042NS	0.094NS
	Pest.	3	4.010**	1.958**	4.549**
	Prot. X Pest.	3	0.066NS	0.069NS	0.003NS
	Error	16	0.688	0.208	0.211
TLC	Prot.	1	2.071**	0.098NS	0.100NS
	Pest.	3	11.190**	7.994**	14.155**
	Prot. x Pest.	3	0.172NS	0.060NS	0.205NS
	Error	16	0.215	0.263	0.521

@ = Protein; # = Pesticide; ** = Significant (P<0.01); * = Significant (P<0.05); NS = Non-significant.

The decrease in Hb contents with the addition of pesticide was possibly due to toxicity which inhibited erythropoiesis in the bone marrow. The findings of the present study agree with those of Iturri (1974) and Westlake *et al.* (1980).

3. Packed cell volume (PCV): The PCV of chicks increased with the advancement of age only at 8 weeks but this increase was relatively less in birds fed on Lannate, with almost no increase at higher pesticide levels (Table 1). Analysis of variance of the data at

all ages showed similar results as given in case of erythrocytic count (Table 2).

The comparison of means at 4 and 6 weeks of age showed significant reduction in PCV of the birds fed different levels of pesticides in comparison to those on feed without pesticide. The differences among various pesticide levels were, however, found non-significant. The mean values of PCV at 8 weeks of age in case of all the pesticide fed groups were significantly lower as compared to that of control group; the differences among the former three groups were also significant.

The reduction in PCV was possibly due to decrease in erythrocytes and Hb contents, and liver damage caused by the pesticide toxicity. The results of the present study are in accordance with those of Iturri (1974).

4. Erythrocytic sedimentation rate (ESR): The ESR values, in general, showed a decrease with increase in age of birds, but these values were relatively higher in birds fed on Lannate, particularly at higher levels (Table 1). Analysis of variance of the data at 4, 6 and 8 weeks of age revealed highly significant difference in ESR due to levels of pesticide (Table 2). However, the impact of protein level, and the protein and pesticide interaction was found to be non-significant.

The comparison of means at the age of 4 and 6 weeks indicated a significant increase in ESR only at 100 and 150 ppm pesticide levels in comparison to control group; the difference between the lower pesticide level and the control group were found non-significant. The ESR at 8 weeks of age increased significantly in all the pesticide fed groups of birds as compared to that on feed without pesticide. The pesticide level of 150 ppm caused a significant increase in ESR in comparison to 50 ppm level; the differences between 50 and 100 as well as 100 and 150 ppm levels were non-significant. When the levels of pesticide increased, the ESR values also increased possibly due to reduction in erythrocytic count.

5. Total leukocytic count (TLC): Increase in TLC with advancement of age was quite apparent at 8 weeks of age, being relatively more in the birds given pesticide (Table 1). The TLC was comparatively higher in the birds fed on Lannate at all ages showing tendency to increase with increase in the levels of pesticide. Statistical analysis of the data revealed highly significant difference in TLC at 4, 6 and 8 weeks of age due to levels of pesticide (Table 2). The impact of protein levels was highly significant at 4 weeks, but non-significant at other ages. The protein and pesticide interaction was, however, found non-significant at all ages.

Comparison of means at 4 weeks of age showed significant increase in TLC with increase in the pesticide levels of birds as compared to those on feed without pesticide; the pesticide fed three groups were also significantly different from one another in this respect. The TLC of birds fed the higher protein level was significantly increased relative to those on lower protein level. The TLC at 6 and 8 weeks of age also increased significantly with increase in pesticide levels of birds relative to control group; the difference between 50 and 150 ppm levels were also significant.

The addition of pesticide resulted in a corresponding increase in TLC of birds due to defence mechanism of body. The pesticide caused toxicity in the body demanding an increased body resistance thus leading to increased production and release of white blood cells into the body in order to combat the influence of pesticide. The results of present study agree with the findings of Rabinovich *et al.* (1982) who observed leukocytosis in the fowls given herbicide.

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