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Hematological studies on the effect of environmental stress (Especially diesel generator caused air pollution) on cockerel bird.

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Abstract

Hematological changes in Cockerel birds exposed to diesel generator exhaust for 30 and 60minutes; at different distance levels i.e. for 2ft, 6ft and 10ft, for different length of period's i.e, 7days, 14days, 21days and 28days and the values were compared with control groups. Each group comprising six birds and values were presented as mean ± S.E and the values were analyzed by F' test at 5% degree level of freedom.Blood samples collected from brachial vein were processed for different hematological parameters viz: - Total erythrocyte count (TEC), Hb%, Packed cell volume (PCV), Total leukocyte count (TLC) were investigated. Total erythrocyte counts were found to be significantly lower in exposed groups. Hb% also significantly decreased. Packed cell volume and Total leukocyte count was significantly increased.

Keywords: Diesel exhaust by Generators; Hematology; Cockerel birds

INTRODUCTION

Environmental pollution is one of the most serious problems, which requires our urgent practical attention. Environmental pollution whether in solid, liquid or gaseous form is causing adverse effects on the behaviour and life of mankind and considerably damaging the animal, bird and plant life.

Diesel exhaust is the emissions of an engine. In diesel engines, conditions in the engine differ from the spark-ignition engine, since power is directly controlled by the fuel supply, rather than by controlling the air supply. Thus when the engine runs at low power, there is enough oxygen present to burn the fuel, and diesel engines only make significant amounts of carbon monoxide when running under a load.

Diesel exhaust has been found to contain many toxic air contaminants. Among these pollutants, fine particle pollution is perhaps the most important as a cause of diesel's deleterious health effects. Exposure to diesel exhaust and diesel particulate matter (DPM) is a known occupational hazard to truck drivers, railroad workers, and miners using diesel-powered equipment in underground mines. Adverse health effects have also been observed in the general population at ambient atmospheric particle concentrations well below the concentrations in occupational settings. Diesel combustion exhaust is a major source of atmospheric soot and fine particles, which is a fraction of air pollution implicated in human cancer, heart and lung damage, and mental functioning. Diesel exhaust also contains Nan particles, which have additional health impacts, and are as yet poorly understood.

In the present study, we used this animal model to examine the effects of Diesel generator caused air pollution on some haematological parameters of Cockerel birds.

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MATERIAL AND METHODS

One day old-healthy Cockerel birds were procured from the local poultry farms and reared for 21 days in metal cages of size (49cm x 52cm x 58cm) (twelve chicks in six each). Birds were given standard diet and water ad- labium as proposed by Bendanova *et al*.(2006).

Analysis of Hematological parameters was done by standard methods as following:

Haemoglobin concentration (Hb%) was measured by adding 20µl of well mixed blood to 5ml of Drabkin, s reagent (Drabkin and Austin, 1935). TLC was done by the Natt and Herrick method (Natt, MP and Herrick, CA 1952). The TLC counts were then calculated using the following formula:

TLC/ microlitre = (Number of leucocytes in 16 squares) x 100

In the present study, we used Birdl model to examine the effects of Diesel generator caused air pollution on some haematological parameters.

TOXICANT

Diesel exhaust (DE) was produced by a generator engines (power = 5kva) which is a mixture of over 450 different compounds especially gases including Carbon mono oxide (CO), Sulphur dioxide (SO_2), Nitrogen oxides (NO_X), Unburnt hydrocarbon (HC) vapours and fine particles.

EXPERIMENTAL DESIGN

1. Control group - The six numbers of birds was exposed to fresh air for each group as control.
2. Ist, IInd and IIIrd groups of six birds were exposed to Diesel

Exhaust (DE) from a distance of 2ft, 6ft and 10ft for 30min respectively up to 7, 14, 21 and 28 Days in different groups.

3. IV^{th,} Vth and VIth groups of birds were exposed to Diesel Exhaust (DE) from a distance of 2ft, 6ft and 10ft for 1hr up to 7, 14, 21 and 28 Days in different groups.

RESULTS

Haemoglobin concentration (Hb %)

A-Data on Haemoglobin concentration in exposed groups and statistical analysis are given in Table-1a. There was reduction in haemoglobin concentration in group- I and group-II than control group. The reduction was statistically significant at 1% level ($p < 0.01$) on 8th day and 22nd day after 7days and 21days of exposure to Diesel exhaust (DE) emitted by generator. It was 5% level ($p<0.05$) in group-I after 14days and 28days in group-III.

B-Data on Hemoglobin concentration in exposed groups (IV, V, and VI) and statistical analysis are given in Table-1b. There was reduction in hemoglobin concentration due to exposure to diesel exhaust (DE) in group- IV and group-V than control group. The reduction was statistically significant at 5% level ($p< 0.05$) for 7days and 14days. It was 1% level ($p<0.01$) in group-V after 21days and 28days in group-IV and group-VI.

Total leukocyte count

A-The statistically analyzed data on TLC were presented in Table-4a. There significant increase in all experimental group than control group on 7 days, 14 days, 21 days & 28 days. Among the exposed group on 7 days it was significantly increase at 1% ($P<0.01$), on 21 days group III it was 5% ($P<0.05$) on 28 days in group III.

B- The data on TLC were presented in Table-4b. It was significantly increased exposed group at 1 % level ($P <0.01$) in group VI on 21 days and in group IV on 28 days while it was significantly at 5 % ($P<0.05$) on 28 days.

Table 1a. Effect of diesel exhaust (DE) emitted by 5kva generator on Hb conc. (gram/dl) of exposed bird at 2ft, 6ft and 10 ft/30 min. compared to control group.

Length of period	**Control group mean ± S.E.**	**Experimental group mean ± S.E.**		
Days	**Control**	**Group-IV (2ft)**	**Group-V (6ft)**	**Group-VI (10ft)**
7	10.94 ± 0.14	8.29 ± 0.58a	7.73 ± 0.08a	9.68 ± 0.27
14	10.44 ± 0.23	8.19 ± 0.56a	8.44 ± 0.64	9.89 ± 0.35
21	10.93 ± 0.05	8.65 ± 0.85	7.36 ± 0.63b	9.24 ± 0.33
28	10.74 ± 0.05	8.49 ± 0.67b	9.52 ± 0.01	8.71 ± 0.45b

*[00 (a) Significant at p<0.05, (b) Significant at p<0.01, (c) Significant at P<0.001]

Table 1b. Effect of diesel exhaust (DE) emitted by 5kva generator on Hb of (gram/dl) exposed bird at 2Ft, 6Ft and 10 Ft/1hr. compared to control group (21 days).

Length of period	**Control group mean ± S.E.**	**Experimental group mean ± S.E.**		
Days	**Control**	**Group-IV (2ft)**	**Group-V (6ft)**	**Group-VI (10 ft)**
7	10.41 ± 0.20	7.91 ± 0.80a	9.32 ± 0.09	8.043 ± 0.29a
14	10.60 ± 0.30	9.43 ± 0.01b	9.37 ± 0.12b	9.30 ± 0.15b
21	10.32 ± 0.05	7.51 ± 0.07a	8.96 ± 0.36	8.43 ± 0.83
28	10.87 ± 0.07	7.96 ± 0.68a	7.08 ± 0.66b	7.35 ± 0.24b

*[00 (a) Significant at p<0.05, (b) Significant at p<0.01, (c) Significant at P<0.001]

Table 2a. Effect of diesel exhaust (DE) of emitted by5kva generator on TLC (1x10^3/μl) of exposed cockerel birds at 2ft, 6ft and 10 ft/30 min. compared to control group (21 days).

Length of period	**Control group mean ± S.E.**	**Experimental group mean ± S.E.**		
Days	**Control**	**Group-I (2ft)**	**Group-II (6ft)**	**Group-III (10 ft)**
7 day	27.05 ± 0.03	28.26 ± 0.12	27.72 ± 0.79	27.14 ± 0.91
14 days	23.47 ± 0.27	29.36 ± 3.07	30.20 ± 3.90	30.63 ± 1.20
21 days	26.28 ± 0.64	29.35 ± 0.44	28.67± 0.97	32.26 ± 0.60b
28 days	26.02 ± 0.58	28.61 ± 0.87	28.82 ± 1.03	30.37 ± 1.03a

*[00 (a) Significant at p<0.05, (b) Significant at p<0.01, (c) Significant at P<0.001]

Table 2 b. Effect of diesel exhaust (DE) of emitted by 5kva generator on TLC(1x10^3/μl) of exposed cockerel birds at 2ft, 6ft, 10 ft/1hr. compared to control group.

Length of period	**Control group mean ± S.E.**	**Experimental group mean ± S.E.**		
Days	Control	Group-IV (2ft)	Group-V (6ft)	Group-VI (10 ft)
7	25.60 ± 1.26	28.07 ± 1.36	27.72 ± 0.79	28.14 ± 0.44
14	23.47 ± 0.27	29.36 ± 3.07	30.23 ± 3.93	30.63 ± 1.20
21	25.04 ± 1.18	27.99 ± 1.26	28.67± 0.97	32.26 ± 0.60b
28	26.34 ± 0.66	32.31 ± 0.73b	28.50 ± 0.78	30.37 ± 1.03a

*[00 (a) Significant at p<0.05, (b) Significant at p<0.01, (c) Significant at P<0.001]

DISCUSSION

In present investigation, we examined direct effect of diesel generator exhaust which consisted soot and many harmful gaseous pollutants on certain hematological parameters of Cockerel birds. Diesel exhaust contains many toxic pollutants such as carbon mono oxide (CO), sulfurdioxide (SO2), oxides of Nitrogen (NOx), and hydrocarbons (HC) etc. i.e; Diesel exhaust act as stressor to edible birds. It is responsible for reduction in growth performance and also affects on following blood parameters of Cockerel birds, such as Hemoglobin concentration (Hb conc.), packed cell volume (PCV), Total leukocyte count (TLC), Total erythrocyte count (TEC).

The results showed that the hemoglobin concentration of cockerel birds of exposed groups were significantly decreased in-groups.

This observation corroborates the findings of Hematological investigations of Morgan *et al. (*1980) showed reduction in hemoglobin content that could be related to the decrease in RBC number which in turn indicates induction of anemic status due to toxic effects. The only other parameters of erythrocyte status and related events were lowered mean corpuscular hemoglobin and mean corpuscular hemoglobin concentration in rats (Ishinishi *et al*.1988), a 3% to 5% increase in carboxyhemoglobin saturation in rats (Karagianes *et al*. 1981). Arunachalam *et al. (*2003) studied Hematological changes in broiler chicken experimentally infected with Ascardia galli eggs.

The results of packed cell volume of the exposed cockerel birds were presented in Table 2a-2b. The results showed that the packed cell volume of cockerel birds of exposed groups were significantly decreased in-groups.

This observation corroborates the findings of Pavitrakar *et al.* 2005) reported effect of Herbal medication on certain hemato-biochemical parameters in induced ochratoxicosis in cockerels. It caused impairment of renal function and thereby decreased levels of hemoglobin and packed cell volume in the cockerels.

The results of total erythrocyte count of the exposed cockerel birds were presented in Table 3a-3b. The results showed that the total erythrocyte count of cockerel birds of exposed groups were significantly decreased in-groups. This observation corroborates the findings of Erythrocyte (RBC) counts were reported as being unaffected in cats (Pepelko and Peirano, 1983), rats and monkeys (Lewis *et al*. 1989) guinea pigs and rats (Penney *et al*. 1981), and rats (Karagianes *et al*. 1981); lowered in rats (Heinrich *et al*., 1982); and elevated in rats (Ishinishi *et al.,* 1988; Brightwell *et al.,* 1986. This observations also corroborates the findings of Llacuna *et al* (1996) reported Haematological and plasma parameters of three species of passerine birds subjected to air pollution by SO2and NOx .They observed that in Parus major and Emberiza cia there is a decrease in R.B.C and an increase in MCV and MHC.

The results of total leukocyte count of the exposed cockerel birds were presented in Table 4a-4b. The results showed that the total leukocyte counts of cockerel birds of exposed groups were significantly increased in groups as compare to control group.

This observation corroborates the findings of leukocyte counts were reported to be reduced in hamsters (Heinrich *et al.* 1982); increased in rats (Brightwell *et al.* 1986). Over crowding stress management in broiler chicken with antisressor investigated by Pandurang *et al*. (2011) and concluded that Overcrowing stress depresses the growth and performance of chicken. It affects on hematological parameters such as Hb conc., TLC and DLC. But, normalized after the polyherbal treatment.

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