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HAEMATOLOGICAL PARAMETERS CHANGE IN COCKEREL BIRD EXPOSED TO ENVIRONMENTAL STRESS (ESPECIALLY DIESEL GENERATOR CAUSED AIR POLLUTION).

Zoology

Rajesh Kumar Dubey P.G. Department of Zoology, Bareilly College, Bareilly, U.P. India

Ramesh chandra* P.G. Department of Zoology,S.S.P.G.College,Shahjahnpur,U.P *Corresponding Author

ABSTRACT

Hematological changes in Cockerel birds exposed to diesel generator exhaust for 30 and 60 minutes; at different distance levels i.e. for 2ft, 6ft and 10ft, for different length of period's i.e. 7 days, 14 days, 21 days and 28 days 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), Packed cell volume (PCV) were investigated. Total erythrocyte counts were found to be significantly lower in exposed groups. Packed cell volume was significantly increased.

KEYWORDS

Hematological Parameters, Diesel Exhaust By Generators, Cockerel Birds.

INTRODUCTION

Air pollution is a general term that covers a broad range of contaminants in the atmosphere. Discussions about the effects of air pollution have focused mainly on birds but attention is being directed to environmental quality and amenity as well. Air pollutants are found as gases or particles, and on a restricted scale they can be trapped inside buildings as indoor air pollutants. Urban air pollution has long been an important concern for civic administrators, but increasingly, air pollution has become an international problem.

The most characteristic sources of air pollution have always been combustion processes. Here the most obvious pollutant is smoke. However, the widespread use of fossil fuels has made sulfur and nitrogen oxides pollutants of great concern. With increasing use of petroleum-based fuels, a range of organic compounds have become widespread in the atmosphere.

By activities of pollution control board, strictness and instructions of hon'ble Supreme Court and due to alertness of public and social organizations, status of air pollution in the factories and automobiles is declining. Now we have lead free petrol and scrubbers in automobiles and effluent treatment plants (ETP) in most of the factories.

Most of the air pollution causing industries are banned now or are equipped with Effluent treatment plants and some of them have been shifted to outer areas of the cities. But due to power shortage use of generators is rapidly increasing in number in different localities, colonies, markets, schools, colleges and on the cross-roads in Bareilly city.

A diesel generator also emits many harmful pollutants like nitrogen oxides (NOx) carbon mono oxide (CO) and sulfur dioxide (SO_2) which evolve by incomplete combustion of diesel oil. It contains a mixture containing over 450 different components. Over 40 chemicals in diesel exhaust are considered toxicants which may result in cancer, exacerbation of Asthma and other health problems.

Besides oxides of Nitrogen, Diesel generator also releases harmful gases such as Carbon monoxide (CO) and Sulfur dioxide (So_2).

Carbon mono oxide (CO) is produced, when carbon containing material burns with insufficient oxygen. It is discharged from gasoline engine and burning of coal. Most of the CO emissions are produced by transport sector like road vehicles, diesel Generators, air crafts etc.

Sulfur dioxide (SO_2) is one of the most common air pollutants which are produced by the combustion and processing of sulfur containing fossil fuels and inhaled SO2 is readily distributed through out the body. Many studies have shown that SO2 exposure not only increase formation of oxygen radicals in the body but also results in formation of sulfur trioxide anion(SO-3) another free radical which form toxic lipid peroxidation product(Curtis *et al.* 1988, Mottley, 1985).
The ultra fine particles of size range less than 0.1µm are formed by nucleation i.e. condensation of low vapor pressure substances formed by high temperature vaporization or by chemical reactions in the atmosphere is to form new particles by chemical reactions They are mainly of anthropogenic origin such as from automobile exhaust, wood smoke and emission from diesel engines and generators (Lippmann *et al.* 1998; Kleeman *et al.* 1999 and Shi *et al.* 1999).

MATERIAL METHODS:

One day old healthy Cockerel birds were procured from the local poultry farms (Jakiruddin poultry farm, cantt, Bareilly) and reared in metal cages of size (49cm x 52cm x 58cm) (six chicks in each). Birds were given standard diet and water ad-libitum as proposed by Central Avian Research Institute (ICAR). Birds were maintained at 32±20c temperature and Humidity was kept in house about 20 - 60% (Bendanova *et al.*2006).

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

Total erythrocyte count (TEC)

Total erythrocyte count(1x106/µl) was done according to the Natt and Herrick method (Natt, MP and Herrick, CA 1952) Fresh blood containing 0.2ml EDTA (ethylenediamine tetra- acetic acid) was drawn into a standard blood dilution pipette till the 0.5 mark followed by methyl violet 2B diluent to the 101mark.

Natt and Herrick, 1952 (Methyl Violet 2B) Diluent

NaCl	3.88g
Na_2SO_4	2.50
Na_2HPO_4. $12H_2O$	2.91g
KH_2PO_4	0.25g
Formalin (37%)	7.50ml
Methyl Violet 2B	0.10g

This gives a final dilution 1:200; the pipette was then briefly agitated, blotted, and the Counting chamber of a Neubauer hemocytometer charged. After a few minutes to allow settling, the red cell count was determined under high magnification (40X objective) Erythrocytes appearing in the center and four corner squares were counted and the total multiplied by 1x106 gave the TEC per micro liter (Fedge, A.M 1997).

Packed cell volume (PCV %)

Blood was colleted in standard (75mm) microhematocrit tubes with anticogluant. These tubes were centrifuged at 12,000xg for 5minutes and read on a standard Microhematocrit graphic reader (Cohen RR, 1967).

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

Toxicant

Diesel exhaust (DE) was produced by a generator engine (power =

5kva). Diesel exhaust is a mixture of over 450 different compounds especially gases including Carbon mono oxide (CO), Sulphur dioxide (SO2), Nitrogen oxides (NOX), Unburnt hydrocarbon (HC) vapours and fine particles.

Experimental design

1. **Control group** - The six numbers of birds were exposed to fresh air for each group as control.
2. Each of the 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 60min up to 7, 14, 21 and 28 days in different groups.

RESULTS

Total erythrocyte count (TEC)

A. Effect of diesel exhaust (DE) on Total erythrocyte count ($1x10^{6}$/µl) of exposed cockerel birds after 30 minutes exposure.

The values have been presented in table-1a.The reduction in TEC was noticed in the entire exposed group. The variation was significant at 0.1% level (P<0.001) in Group II & III on 7 days and on 28 day in Group I. It was significantly reduced at 5% level (P<0.05) in Group II and at 0.1% level (P<0.001) in 28 day.

B. Effect of diesel exhaust (DE) on Total erythrocyte count ($1x10^{6}$/µl) of exposed cockerel birds after 1hr exposure.

The values have been presented in Table-1b.The data on TEC was decreased in exposed group of birds as compared to control group. It was decreased significantly at 5% level (p<0.05) in Group V of 14 days exposure and at 1%level (p<0.01) in Group VI of 7 days exposure. But the reduction was significant at 0.1% level (p<0.001) in Group IV on 7 days and in all groups of 28 days.

Packed cell volume

A-Effect of diesel exhaust (DE) on packed cell volume (PCV %) of exposed cockerel birds after 30 minutes exposure.

The data on packed cell volume (PCV %) with its statistical analysis are shown in Table-2a.

Substantial decrease in PCV was noticed in Group-I, II and III of cockerel birds as compared to control group. The difference was statistically significant in Group- I at 0.1 % level (p<0.001) on 7 days while it was significant at 1 %(p<0.01) on 14days in Group I and III. In Group II, it was found to be 0.1 % level (p<0.001). On 21days, it was significant at 0.1% level (p<0.001) in all group (I, III and II). In case of 28 days exposure, the mean values were significant at 1% level (p<0.01) in Group I & II as compared to its control group.

B- Effect of diesel exhaust (DE) on packed cell volume (PCV %) of exposed cockerel birds after 1hr exposure.

The data on packed cell volume (PCV %) with its statistical analysis are shown in Table-2b.

It decreases in group IV, significant at 1% (p<0.01) and in Group V & VI values were significant at 5% (p<0.05). On 7 days it was decreased at 1% level (p<0.01) in Group IV, V, VI as compared to control group. On 21 days, it was significant at 5 %(P<0.05) in group V than control group while on 28 days it was significant at 0.1 % (p<0.001) than control group.

DISCUSSION

In present investigation, we examined direct effect of 5kva 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 (SO^2), oxides of Nitrogen (NOx), and hydrocarbons (HC) etc. 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 (Hbgm %), Packed cell volume (PCV), Total leukocyte count (TLC), Total erythrocyte count (TEC), Erythrocyte sedimentation rate (ESR) and Differential leukocyte count (DLC).

Many factors influence the total erythrocyte count in birds. Therefore the total erythrocyte count is of important value in following the course of disease in the individual bird. Factors influencing erythrocyte count include species variation, age, sex, hormonal influences, hypoxia and environmental factors.

It is very interesting to note that in some mammalian models, environmental stress lowered the total erythrocyte count (TEC). In other mammals an elevation in TEC count was also recorded.

The results of packed cell volume of the exposed cockerel birds were presented in Table 1a-1b.

In the present work the total erythrocyte counts of cockerel birds of exposed groups were significantly decreased at 5% level (P<0.05) in Group II as compared to control group. It was also decreased significantly at 5% level (P<0.05) in group V of 14 days exposure. This observation corroborates the findings of Heinrich *et al.* (1982) because they had also recorded a decrease in total erythrocyte count in rats. However, erythrocyte counts were reported as being unaffected in rats (Karagianes *et al.* 1981); guinea pigs and rats (Penney *et al.* 1981), cats (Pepelko and Peirano, 1983), in rats and monkeys (Lewis *et al.* 1989) An increase in total erythrocyte count was recorded in rats by Brightwell *et al.* (1986) and Ishinishi *et al.* (1988).

Our observation also corroborates the findings of Llacuna *et al.* (1996). They reported haematological and plasma parameters of three species of passerine birds subjected to air pollution by SO_2 and NOx .They observed that in *Parus major* and *Emberiza cia* there is a decrease in red blood cells (R.B.C) and an increase in MCV and MHC. In *Turdus merula*, there is a decrease in weight and increase in transamines (GOT and GPT).

The results showed that the packed cell volume of cockerel birds were presented in table 2a and 2b. The packed cell volume of cockerel birds of exposed groups was significantly decreased at 1 %(p<0.01) on 14days in Group I and III. On 7 days exposure it was decreased at 1% level (p<0.01) in Group IV, V, VI as compared to control group. On 21 days exposure, it was significant at 5 %(p<0.05) in Group V as compared to control group.

This observation corroborates the findings of Pavitrakar *et al.* 2005) who 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.

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