



Effect of sulphur dioxide exposure on haematological parameters in albino rats

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Abstract The present study investigation was carried out to evaluate the toxicological effect of sulphurdioxide on haematological (Total erythrocyte count, Haemoglobin, Haematocrit, MCH, MCHC, MCV) indices of albino rats. The rats were exposed to 25 ppm of sulphur dioxide for one hour daily for a period of two months. Results indicated that the total erythrocyte count, haemoglobin, haematocrit and mean cell volume were increased significantly, whereas, No significant change was observed in mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration after sulphur dioxide exposure.

Keywords sulphur dioxide, albino rats, haematology

Introduction

Air pollution has become very serious problem for the modern industrialized world. The main gaseous pollutant includes sulphur dioxide, nitrogen oxides, carbon monoxides, hydrocarbons, etc [1]. Sulphur dioxide is a common air pollutant. It is generally emitted from combustion of sulphur containing fossil fuels like coal, metal smelting, motor vehicle operations, and other industrial process. It is a highly water soluble irritant gas which is rapidly taken up by the nasal passage during the course of breathing [2]. The exposure of sulphur dioxide causes respiratory irritation, bronchial constriction, shortness of breath and bronchial hyper reactivity [3]. Respiratory system is the prime target of sulphur dioxide toxicity but it can also affect other organs and systems by entering into the systemic circulation through the blood stream [4]. Haematological observations have greater contribution to the pathological changes during toxicological studies. Therefore haematological investigations can be used to screen the state of health of experimental animals.

Material and Methods

For the present study, male Wister rats weighing 140-150 g were procured from small animal house, Hisar. Rats were acclimatized for two weeks and then rats were exposed to 25 ppm sulphur dioxide exposure daily for 1hour for a period of two months as described in earlier study [5]. The animals were maintained under 12:12 hr light and dark cycles (temperature 25 ± 1 °C and relative humidity 50-60 %) and fed on commercial pellet diet obtained from M/S Lipton India Pvt. Ltd. Bangalore, and tap water ad libitum. Animals were under continuous observations during the period of exposure. After treatment the rats were starved overnight and sacrificed by light ether anaesthesia. Blood was collected in heparinized vials by cardiac puncture.

Haematological investigations were conducted in control and experimental groups of rats. The total number of erythrocytes per cubic millimetre of blood was calculated with the help of haemocytometer using Neubaur's counting chamber as given by Dacie and Lewis(1977) [6]. Haemoglobin concentration was estimated by acid haematin method by using Sahli'shaemometer. Haematocrit (Hct) was determined by using Wintrobe's method. Mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), and mean corpuscular volume (MCV) were calculated according to standard method as given by Dacie and Lewis, 1977 [6].



Statistical Analysis

All the experimental results were expressed as arithmetic mean \pm standard deviation. The statistical significance of mean values between different groups was determined by using student's t-test. Values of $p < 0.05$ were considered significant.

Results and Discussion

Exposure of sulphur dioxide produced significant changes in the haematological parameters. Increase in haemoglobin and red blood cell count was observed. 9.55% of increase in total erythrocyte count was observed in sulphur dioxide exposed rats. Similarly, 12.17% increase in haemoglobin concentration was observed in rats exposed to sulphur dioxide in comparison to the control group (figure 1).

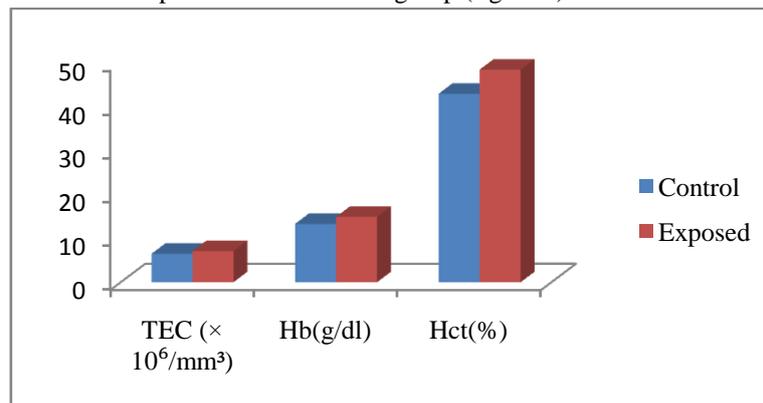


Figure 1: Alteration in TEC, Hb and Hct of exposed rats in comparison to control

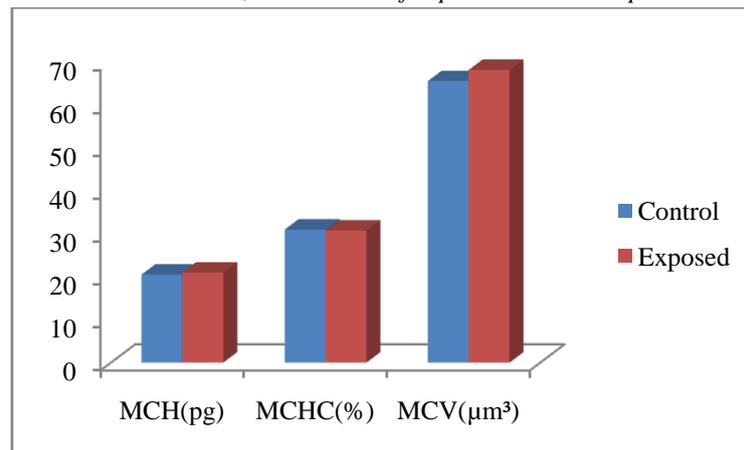


Figure 2: Alteration in MCH, MCHC and MCV of exposed rats in comparison to control

To cope up with the stress caused by sulphur dioxide exposure, this may be a reaction to chronically low oxygen level in the blood. This might have been caused by the production of erythropoietin hormone by the kidney due to hypoxic condition prevailing in the environment of animals during the exposure. This hormone is acting on the bone marrow causing the increased production of reticulocytes thus increasing haemoglobin production. [7-8]. In the present study, there was 12.79% increase in haematocrit value (figure 2). The increase in packed cell volume can be attributed to increase in total erythrocyte count. No significant change was observed in MCH in sulphur dioxide exposed rats in comparison to control rats. While, a decrease of 0.64 % was observed in MCHC, though not significant. The increase of 3.96 was observed in MCV of the albino rats. The present study results are in agreement with Etlik and Tomur [9] which described increase in red blood cells, haemoglobin concentration and haematocrit value may be due to decreased plasma volume related with increased vascular permeability induced by irritant effect of sulphur dioxide, or it can be caused by functional anaemia due to sulphaemoglobinemia. Similar findings were observed by Baskrut [10]. Singh [11] also recorded similar observations in mice following sulphur dioxide exposure of 15 ppm. Various studies reported that at higher



doses there is significant decrease in red blood cell count and haemoglobin concentration [12-14]. Pandey et al., [13] suggested that alteration in haematological parameters were dose dependent.

Conclusion

In the present study sulphur dioxide exposure to rats caused significant changes in haematological indices and revealed increase in total erythrocyte count, haemoglobin concentration and haematocrit values. This may have occurred to cope up with the stress caused by sulphur dioxide exposure that has led to functional anaemia due formation of sulphaemoglobin which in turn led to increased erythropoietic activity.

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