

Exposure to Oil Paint Vapor: Health Risk for Blood System

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Abstract—Studies have shown that volatile emissions of chemicals may result in various disorders in our body. The main aim of this study was to determine the effects of oil paint vapor on red blood cells, HCT and Hb in male rats. In this experimental laboratory study, male Wistar rats were randomly divided into control and exposed to oil paint vapor for 1h/day and 8h/day. After 10 weeks blood samples were collected using cardiac puncture method. Red blood cell count, HCT and Hb measurement were performed using routine methods. Data were statistically analyzed and compared between groups using ANOVA. The results indicated that RBC number significantly decreased in rats exposed to oil paint vapor for 8h/day compared with control animals ($p<0.05$). HCT and Hb concentration significantly decreased in animals exposed to oil paint vapor for 1h/day and 8h/day compared to control rats ($P<0.01$). Conclusively, exposure to oil paint vapor results in decreased RBC number and decreased HCT and Hb may lead to anemia or other disorders of blood system.

Keywords— Oil Paint Vapor, RBC, HCT, Hb, Rat.

I. INTRODUCTION

STUDIES on indoor pollution caused by pollutants such as volatile gases are important since it may impair human health. The poor quality of indoor condition resulting from oil paint emissions at the period of time that the ceiling, walls and doors are painted may cause adverse effects for whom dealing with oil paint emissions.

Painting with oil poses many health risks which are usually associated with the solvents and powdered pigments used in oil paints. Cancer causing compounds used in oil painting can enter the body through the nose, mouth or eyes, and can even be absorbed directly through the skin and pose many dangers once inside the body. There are also chemicals inside the paints that can cause poisoning, even in low concentrations. There are two types of chemicals that are used in paints that can cause poisoning inside the body, they are organic hydrocarbons and heavy metals. Metals such as lead, mercury, barium and cobalt are all used as pigments in oil paints and are all very hazardous to health. The symptoms associated with oil paint are similar to other types of indoor pollution caused by volatile compounds

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including headache, nausea, irritation of the eyes, drowsiness, and fatigue. Among the Volatile Organic Compounds(VOCs), benzene is confirmed as a human carcinogen. The other VOCs, such as hexane, heptane and octane can affect the central nervous system. The main sources of VOCs in the indoor environment are building materials, furnishing, cleaning compounds, dry cleaning agents, paints, glues, cosmetics and textiles [1] –[5].

The effects of benzene which is found in oil paint emissions include leukocytopenia, thrombocytopenia, anemia, transitory leukocytosis, lymphopenia, rarely lymphocytosis, very rarely pseudo-PelgerHuet anomaly changes in the leukocyte osmotic resistance, decreased phagocytic function of granulocytes, reduced glycogen content and inhibited activity of peroxides of neutrophils, an increase in the acid phosphatase and β -glucuronidase activity of the neutrophils, and a decrease of alkaline phosphatase, myeloperoxidase and lipid content of the neutrophils. An increase of eosinophils, basophils, and monocytes in chronic benzene toxicity is matter of discussion [6]. The main aim of this study was to determine the effects of oil, paint, vapor, on red blood cells , HCT and HB in male rats.

II. MATERIAL AND METHODS

A. Animals

Adult male Wistar rats weighting 200 ± 30 g were purchased and raised in our colony from an original stock of Pasteur institute (Tehran, Iran).The temperature was at 23 ± 2 °C and animals kept under a schedule of 12h light: 12h darkness with free access to water and standard laboratory chow.

B. Protocol of Study

Male rats were randomly divided into control and exposed to oil paint vapor for 1h/day and 8h/day. After 10 weeks blood samples were collected using cardiac puncture method. Red blood cell count, HCT and Hb measurement were performed using routine methods.

C. Statistical Analysis

All values are presented as mean \pm SD. Statistical significance was evaluated by one-way analysis of variance (ANOVA) using SPSS 19 and Tukey HSD Test as post hoc test. Differences with $P<0.05$ were considered significant.

III. RESULTS

Figure I represents RBC number in control and rats exposed to oil paint vapor for 1 and 8h/day. The results indicated that

RBC number significantly decreased in male rats exposed to oil paint vapor for 8h/day compared with control animals ($p<0.05$); however, there was no significant difference between rats exposed to oil paint vapor for 1h/day and control group. There was no also significant difference between rats exposed to oil paint vapor for 1h/day and rats exposed to oil paint vapor for 8h/day.

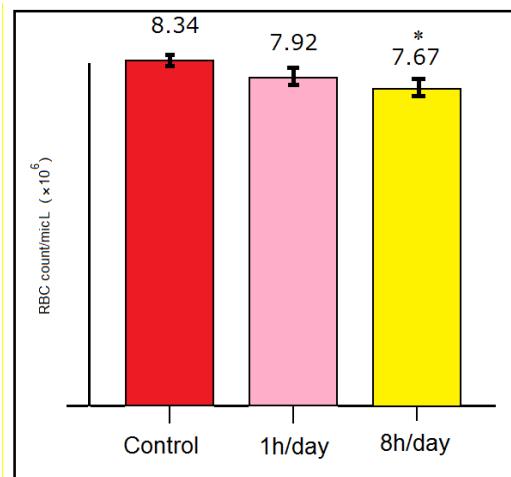


Fig. 1 RBC number (Mean \pm SD) in control animals and rats exposed to oil paint vapor for 1 and 8h/day. * represents significant difference compared to control group.

Figure II represents HCT in control and rats exposed to oil paint vapor for 1 and 8h/day. The results indicated that HCT significantly decreased in male rats exposed to oil paint vapor for 1h/day and 8h/day compared with control animals ($p<0.01$); however, there was no significant difference between rats exposed to oil paint vapor for 1h/day and 8h/day.

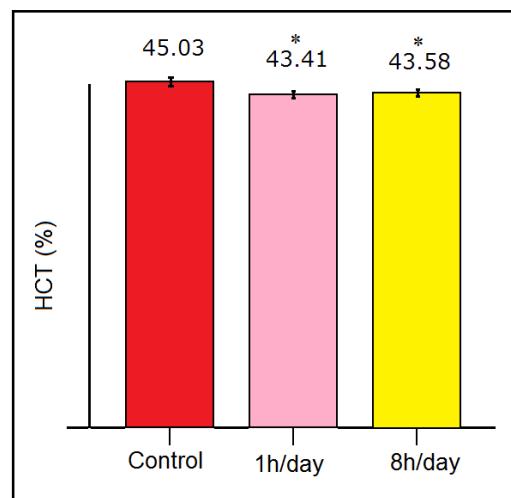


Fig. 2. HCT (Mean \pm SD) in control animals and rats exposed to oil paint vapor for 1 and 8h/day. * represents significant difference compared to control group.

Figure III represents Hb in control and rats exposed to oil paint vapor for 1 and 8h/day. The results indicated that Hb level significantly decreased in male rats exposed to oil paint vapor for 1h/day and 8h/day compared with control animals

($p<0.01$); however, there was no significant difference between rats exposed to oil paint vapor for 1h/day and 8h/day.

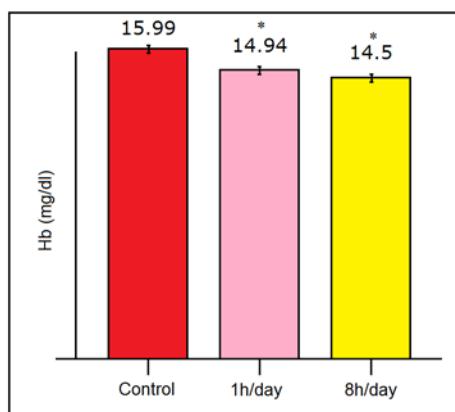


Fig. 3 Hb (Mean \pm SD) in control animals and rats exposed to oil paint vapor for 1 and 8h/day. * represents significant difference compared to control group.

IV. DISCUSSION

The results of current research show that exposure to paint odor results in decreased red blood cells in blood system of male and female rats. Studies on indoor pollution caused by oil paint is of importance because there are many people that are exposed to oil paint emissions for long periods of time in their life span, such as workers working in the oil paint industry and painting area. In this study we evaluated the effect of oil paint vapor on blood system. In line with our findings there are other studies indicating that exposure to oil paint emission influence human blood system [1]. The chemical substances in oil paint have the major destroying effects. According to Srivastava study, in 2000, on VOC (the main resource of building materials like oil paints) one of the most important substance is benzene [6]. The hemotoxicity of chronic benzene poisoning has been well known for nearly a century. Aksoy, in 1989, showed that the chemical substance like benzene, that is in paints too, cause leukocytopenia, thrombocytopenia [7]. It has also been shown that child and maternal household chemical exposure can increase the risk of acute leukemia in children with Down's syndrome [8]. The studies show that paint is as a source of recontamination of houses in urban environments and has role in maintaining elevated blood leads in children [9]. It has also been demonstrated the household exposure to paint and petroleum solvents enhances the risk of childhood leukemia [10]. As a whole, it can be said that long-term exposure to benzene can bring about destructive effects on blood, especially on bone-marrow cells and may lead to reduced hematopoietic activity of bone marrow resulting in reduced red blood cells in blood system and reduced Hb and HCT.

V. CONCLUSION

We have shown that exposure to oil paint vapor results in decreased number of red blood cells and decreased HCT and Hb concentration in male rats, indicating the impact of oil paint

exposure on red blood cells which can lead to anemia or other disorders in blood system.

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