The Association between Serum Testosterone Levels and Erythrocyte Count in Male Rats Exposed to Oil Paint Vapor

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***Abstract*---** The studies show that testosterone stimulate erythrogenesis. The main aim of this study was to determine the effects of oil paint vapor on serum testosterone level and RBC count in male rats to show the relationship between RBC count and serum levels of testosterone in male rats exposed to oil paint vapor. 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. The cell count method was carried out by using routine laboratory method and serum level of testosterone was measured using radioimmunoassay method. Data were statistically analyzed and compared between groups using ANOVA. The results indicated that RBC counts significantly decreased in rats exposed to oil paint vapor for 8h/day ($P<0.01$). Serum testosterone level significantly increased in rats exposed to oil paint vapor for 1h/day ($P<0.001$) and decreased in rats exposed to oil paint vapor for 8h/day ($P<0.001$). Our findings have shown that increased testosterone did not influence RBC count in oil paint vapor receiving male rats, however, decreased serum level of testosterone was correlated with decreased RBC count.

***Index Terms*---** Oil Paint Vapor, Testosterone, RBC count, Male Rat.

I. INTRODUCTION

Chemicals vary in their ability to produce odors and people vary in their ability to smell odors. Odor is not a reliable way to determine the risk of health effects. For some chemicals, odors will be noticeable at low concentrations where the risk for health effects is also very low. For others, such as carbon monoxide, there is no odor at any concentration and no warning when people are exposed to dangerous levels. Volatile organic compounds (VOCs) are solvents that get released into the air as the paint dries. Volatile organic compounds are also chemicals that easily enter the air as gases from some solids or liquids. They are ingredients in many commonly used products and are in the air of just about every indoor setting. The ability of organic chemicals to cause health effects varies greatly from those that are highly toxic, to those with no known health effects. As with other pollutants, the extent and nature of the health effect will depend on many factors including level of exposure and length of time exposed. Eye and respiratory tract irritation, headaches, dizziness, visual disorders, and memory impairment are among the immediate symptoms that some people have experienced soon after exposure to some organics. At present, not much is known about what health effects occur from the levels of organics usually found in homes. Many organic compounds are known to cause cancer in animals; some are suspected of causing, or are known to cause, cancer in humans. Respiratory, allergic, or immune effects in infants or children are associated with man-made VOCs and other indoor or outdoor air pollutants. Some VOCs, such as styrene and limonene, can react with nitrogen oxides or with ozone to produce new oxidation products and secondary aerosols, which can cause sensory irritation symptoms. [1], [2]

Testosterone is a steroid hormone from the androgen group and is found in humans and other vertebrates. In humans and other mammals, testosterone is secreted primarily by the testicles of males and, to a lesser extent, the ovaries of females. Small amounts are also secreted by the adrenal glands. It is the principal male sex hormone and an anabolic steroid. In men, testosterone plays a key role in the development of male reproductive tissues such as the testis and prostate as well as promoting secondary sexual characteristics such as increased muscle, bone mass, and the growth of body hair.[3] In addition, testosterone is essential for health and well-being[4] as well as the prevention of osteoporosis.[5]

Testosterone also regulates production of monocytes and lymphocytes – white blood cells that are essential to immunity.[6] Experimental lowering of testosterone is associated with a decrease in heart weight and contractile function, which is corrected with testosterone replacement.[7]

Research has clearly shown the effects of testosterone on the blood vessels, and they are beneficial. In the past, testosterone has been considered as one of the risk factors for coronary artery disease because men are more likely than women to show up in the doctor's office with cardiovascular problems. The notion that normal levels of testosterone could cause atherosclerosis (hardening of the arteries) developed over many years and was accepted by many despite the complete lack of evidence supporting this idea. [8]

Other studies have demonstrated that, in addition to the testosterone effects on the blood vessel lining, there are

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relaxing effects on the blood vessel smooth muscle. These effects are explained by an inhibition of calcium entry into the cells. This relaxation is also accomplished by testosterone helping potassium enter blood vessel cells. The coronary arteries were found to be more sensitive to relaxation by testosterone than the aorta in both men and women.[9] Testosterone treatment induces erythrocytosis that could potentially affect blood viscosity and cardiovascular risk. [10]

Testosterone also stimulates erythropoiesis and regulates iron homeostasis. [11] The main aim of this study was to determine the effects of oil paint vapor on serum testosterone level and RBC count in male rats to show the relationship between RBC count and serum levels of testosterone in male rats exposed to oil paint vapor.

II. Material And Methods

A. Animals

In this experimental laboratory study adult male Wistar rats weighting 200±30g were purchased and raised in our colony from an original stock of Pasteur institute (Tehran, Iran).The temperature was at 23±2 ^{0}C and animals kept under a schedule of 12h ight: 12h darkness with free access to water and standard laboratory chow.

B. Protocol of Study

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. The RBC count method was carried out by using routine laboratory method and serum levels of testosterone was measured using radioimmunoassay method.

C. Statistical Analysis

Statistical significance was evaluated by one-way analysis of variance (ANOVA) using SPSS 19. Significance was measured using Turkey's test. Differences with P<0.05 were considered significant

III. Results

Figure I represents serum testosterone level in male rats exposed to oil paint vapor for 1h/day and 8h/day.

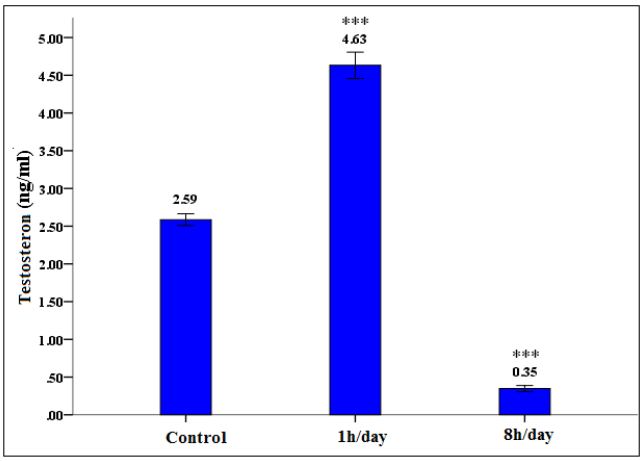

Fig. 1 Serum testosterone level in control animal and male rats exposed to oil paint vapor for 1h/day and 8h/day. *** indicates significant difference at P<0.001 compared with control animals.

Figure II represents RBC count in control male rats and male rats exposed to oil paint vapor for 1h/day and 8h/day. The results indicated that RBC count did not significantly change in experimental rats compared with control group.

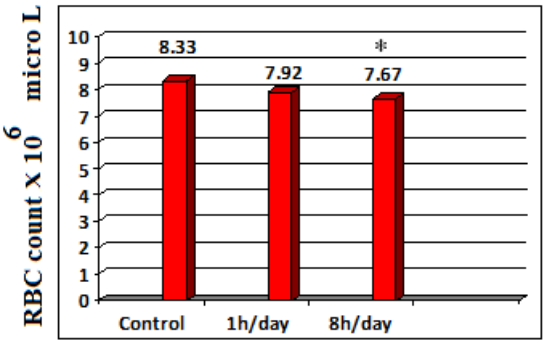

Fig. 2 RBC count in control male rats and male rats exposed to oil paint vapor for 1h/day and 8h/day. * indicates significant difference at P<0.01 compared with control animals.

The results indicated that RBC counts significantly decreased in rats exposed to oil paint vapor for 8h/day (P<0.01). Serum testosterone level significantly increased in rats exposed to oil paint vapor for 1h/day (P<0.001) and decreased in rats exposed to oil paint vapor for 8h/day (P<0.001).

IV. Discussion.

Our findings have shown that exposure to oil paint vapor for long time is followed by decreased serum testosterone level and RBC count. However, increased serum level of testosterone was not correlated with increased RBC count in oil paint vapor receiving male rats. In line with our findings there are other studies showing that exposure to oil paint vapor takes serious hazardous effects on body systems [12]. Studies show that there is relationship between neurological and immunological diseases due to exposure to volatile organic compounds [13]. The results also indicate a relationship between emissions of VOCs and the incidence of some types of cancers. [14] The studies show that exposure to vehicle exhausts may have adverse effects on the male reproduction system. [15] There are also reports indicating that testosterone has a pivotal role in erythrogenesis. [11] The studies show that reduced RBC counts and haemoglobin levels is associated with low testosterone concentrations. [16] Testosterone supplementation can also normalize the iron status and further stimulated splenic erythropoietic activity; both may contribute to improve the anemic condition. [17] Testosterone stimulates erythropoietin synthesis. Erythropoietin also is a potent factor in erythrogenesis. [18] It is proposed that reduced testosterone level in rats exposed to oil paint vapor may reduce erythropoietin synthesis resulting in reduced erythrogeneis causing ti reduced RBC count.

V. Conclusion

We have shown that increased serum testosterone level did not influence RBC count in oil paint vapor receiving male rats, however, decreased serum levels of testosterone was correlated with decreased RBC count.

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