Is There a Relationship between Serum Sex Steroid Hormones Levels and RBC Count in Female Rats Exposed to Oil Paint Vapor?

Siavashi M., Ahmadi R., and Alipour F.*

***Abstract*--** Studies have shown that volatile emissions of chemicals have significant effects on various body systems. The main aim of this study was to determine the effects of oil paint vapor on RBC count and sex steroid hormones (estradiol and progesterone) in female rats to show the relationship between RBC count and serum levels of sex steroid hormones in female rats exposed to oil paint vapor. In this experimental laboratory study, female 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 levels of estradiol and progesterone were measured using radioimmunoassay method. Data were statistically analyzed and compared between groups using ANOVA. The results indicated that RBC counts did not significantly changed in experimental groups compared to control animals, however, serum estardiol and progesterone levels significantly increased in rats exposed to oil paint vapor for 1h/day ($P<0.01$ and $P<0.001$, respectively) and decreased in rats exposed to oil paint vapor for 8h/day ($P<0.001$). The results have shown that despite significant change in serum levels of estradiol and progesterone, the RBC count did not significantly change.

***Index Terms*--** Oil Paint Vapor, Estradiol, Progesterone, Female Rat.

I. INTRODUCTION

Estradiol, or more precisely, 17β-estradiol, is the primary female sex hormone. It has a pivotal role in development and function of female reproductive system [1]. It has also important effects on many other systems including bone, muscular, nervous and digestive system. While estrogen levels in male are lower compared to females, estrogens have essential functions in males as well. Estradiol is found in most vertebrates as well as many crustaceans, insects, fish, and other animal species [2].

Progesterone is an endogenous steroid hormone involved in the menstrual cycle, pregnancy, and embryogenesis of humans and other species. It belongs to a group of steroid hormones called the progestogens [3] and is the major progestogen in the body. Progesterone is also a crucial metabolic intermediate in the production of other endogenous steroids, including the sex hormones and the corticosteroids, and plays an important role in brain function as a neurosteroid [4].

Experimental evidences suggest that estradiol plays important role in blood system. The findings indicate that this hormone inhibits production of erythropoietin (EPO) in female rats, when rats have exposed to various intensities of hypoxia [5]. Estradiol decreases EPO gene expression during hypoxia. Accordingly, the protective roles of EPO against oxidative stress may change when estradiol is accompanied by EPO [6]. It has been demonstrated that 17β-estradiol (E2-β) can influence the expression of hypoxia-inducible genes such as vascular endothelial growth factor and endothelin-1 as well [7]. In some tissues such as the uterus and ovaries, E2-β has been shown to induce EPO production [8]. There are other studies also showing that estradiol influence blood indices in males and females [9], [10]. Progesterone also influences blood indices as well as estrogen [11].

Studies also show that exposing to paint odor accounts for a variety of blood disorders in males and females [12]-[14].

The data on the effects of estrogens and progestins on blood system are sometimes conflicting. The main aim of this study was to determine the effects of oil paint vapor on RBC count and sex steroid hormones (estradiol and progesterone) in female rats to show the association between RBC count and serum levels of sex steroid hormones in female rats exposed to oil paint vapor.

II. MATERIAL AND METHODS

A. Animals

In this experimental laboratory study adult female 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, female 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

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and serum levels of estradiol and progesterone were 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 estradiol level in female rats exposed to **oil paint vapor for 1h/day and 8h/day.**

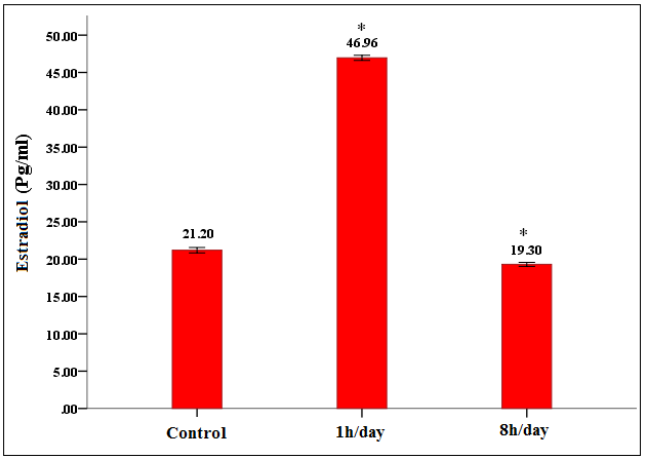

Fig. 1 Serum estradiol level in control animal and female rats exposed to oil paint vapor for 1h/day and 8h/day. ** indicates significant difference at P<0.001 and * indicates significant difference at P<0.01 compared with control animals.

Figure II represents serum alpha-hydroxy progesterone level in female rats exposed to oil paint vapor for 1h/day and 8h/day.

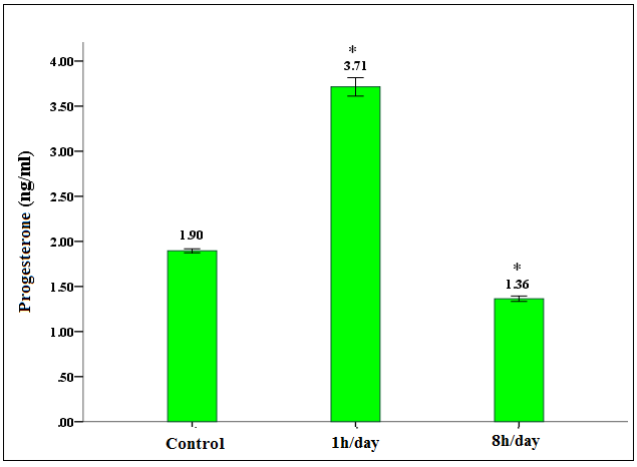

Fig. 2 Serum alpha-hydroxy progesterone level in control animal and female rats exposed to oil paint vapor for 1h/day and 8h/day. * indicates significant difference at P<0.001 at P<0.01 compared with control animals.

Figure III represents RBC count in control female rats and female 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.

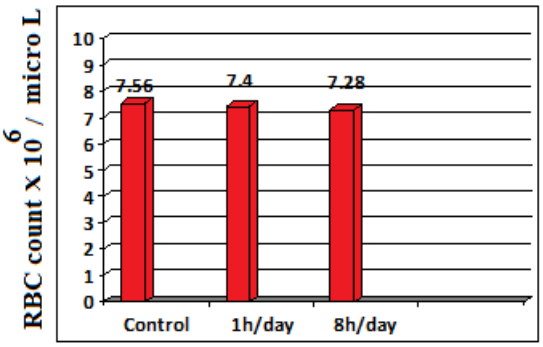

Fig. 3 RBC count in control female rats and female rats exposed to oil paint vapor for 1h/day and 8h/day..

The results indicated that RBC counts did not significantly changed in experimental groups compared to control animals, however, serum estardiol and progesterone levels significantly increased in rats exposed to oil paint vapor for 1h/day (P<0.01 and P<0.001, respectively) and decreased in rats exposed to oil paint vapor for 8h/day (P<0.001).

IV. DISCUSSION

The results of current research show that despite changes in estradiol and progesterone level in female rats exposed to oil paint vapor, there was not significant change in RBC count in peripheral blood. Steroidogenic pathway is influenced by exposure to various components derived from petroleum [15], [16]. Occupational and environmental exposures to lead (Pb), one of the toxic metal pollutants existing in petroleum derivatives including oil paint, is of global concern. The studies show that cholesterol metabolism is changed in subjects exposed to Pb [17]. Therefore, it is expected that steroidogenic pathway to be changed following exposure of female subjects to petroleum derivatives including oil paint , resulting in changes in serum levels of female steroid hormones. Effects of automobile lead on the general growth and sexual activity of the rat has also been observed [18].

Despite our finding, recently it has been shown that inhaling of petrol vapours causes adverse effects on weight gain, blood cell indices and bone marrow megakaryocytes, but does not cause significant changes in oxidative markers in erythrocytes [19].

On the other hand, there are numerous studies showing that sex steroids play a pivotal role in red blood cell synthesis [5]-[11]. However, in contrast to these findings we did not observe significant change in red blood cell count in rats experiencing change in serum levels of estradiol and progesterone. Further research is required to confirm our finding.

V. CONCLUSION

We have shown that despite changes in serum estradiol and progesterone level in female rats exposed to oil paint vapor, there was not significant change in RBC count in peripheral blood. Therefore, our finding shows that serum estradiol or progesterone level change cannot influence RBC count .

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