The Effects of Gasoline Vapor Inhalation on Testes Tissue in Male Rats

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Abstract—Gasoline is one of the sources of emissions, which can endanger health if used incorrectly as a matter of respiration. The present study was exerted to evaluate the effects of gasoline vapor inhalation on testes tissue in male rats. In our study male Wistar rats were randomly divided into control, gasoline vapor receiving for 1 hour, 2 hours and 3 hours/day. After 10 weeks, testes tissue was examined histologically using HE staining method. Data were statistically analyzed and compared between groups using one-way ANOVA. The results indicated that seminiferous tubules were deformed in animals exposed to gasoline vapor compared to control animals. The number of spermatocytes and spermatogonia was also lower in rats exposed to gasoline vapor compared with control animals (P<0.001). Our findings indicate that inhalation of gasoline vapor is a serious risk factor for reproductive system in males.

Keywords—Gasoline vapor, Testes tissue, Rat.

I. INTRODUCTION

Inhalation of fuel creates numerous pathophysiological effects on the endocrine system, cardiovascular system, central nervous system, liver, kidney and reproductive system [1, 2]. The reports in petrol pump workers indicate that gasoline vapor inhalation has adverse effects on human health [3]. On the other hand, there is association between inhalation exposure to gasoline and the sex steroid hormones [4]. Studies have found that the leaded gasoline pollutes more than unleaded gasoline or diesel fuels, and that the lead present only in the first type would be the active element responsible for the masculine infertility and body weight gain reduction in rats [5]. Some components of gasoline were found to cause testicular tumors, leukemias, dysplastic proliferations of lymphoreticular tissues, and uterine sarcomas [6]. The studies also have shown that gasoline components have serious impact on testes tissue [7].

II. MATERIAL AND METHODS

A. Animals

Adult 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 °C and animals kept under a schedule of 12h light:12h darkness (light on at: 08:00 a.m.) with free access to water and standard laboratory chow.

B. Exposure to gasoline vapour

The method of exposure employed in this study was by inhalation as previously described [5], however, with changes. In this exposure method, the animals were exposed to gasoline vapours in the exposure chambers. Highly perforated cans containing 300ml of gasoline were placed in the exposure chamber and the animals were allowed to inhale the vapours generated from the direct evaporation of liquid gasoline from the cans.

C. Protocol of Study

Male Wistar rats were randomly divided into control animals, and rats that received gasoline vapor for 1 hour, for 2 hours and for 3 hours. The exposure period of 1, 2 and 3 hours daily was adopted for 10 weeks. The liquid gasoline (PMS blend) was obtained from Mobil refueling station, Ghorveh, Iran. At the end of the experimental period, the animals were anaesthetized and testis histological studies, testes were removed and after fixation in Bouin’s solution, testis tissue was transferred into ethanol 70% without being processed for 17.5 h in an automated Shandon processor and embedded in paraffin wax. Sections of 5 μm thickness were cut, floated onto slides coated with 2% 3-aminopropyltrietoxysilane and dried at 50 °C overnight before being used for cell quantification studies. All animal experiments were carried out in accordance with the guidelines of Institutional Animal Ethics Committee.

D. Statistical Analysis

All values are presented as mean ± S.E.M. Statistical significance was evaluated by one-way analysis of variance (ANOVA) using SPSS 19. Differences with P<0.05 were considered significant.

III. RESULTS

Seminiferous tubules were deformed in animals exposed to gasoline vapor compared to control animals, however, the seminiferous diameter was not significantly changed. The
number of spermatozoon and spermatogonia was lower in rats exposed to gasoline vapor compared with control animals (P<0.001). Table I shows seminiferous tube diameter and number of spermatogonia in seminiferous tunnel in male rats (Table 1).

<table>
<thead>
<tr>
<th>Group</th>
<th>Seminiferous tubule diameter (µm)</th>
<th>P</th>
<th>Number of spermatogonia in seminiferous tubule tunnel</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>26.8±4.03</td>
<td></td>
<td>60.7±11.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Gasoline vapor (1 h)</td>
<td>27.6±3.2</td>
<td>NS</td>
<td>36.5±8.2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Gasoline vapor (2 h)</td>
<td>27.0±2.9</td>
<td>NS</td>
<td>44.3±15.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Gasoline vapor (3 h)</td>
<td>27.6±4.3</td>
<td>NS</td>
<td>52.7±11.2</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

The data are indicated as mean ± SEM. P values are expressed in comparison with control group.

IV. DISCUSSION

In our study, inhalation of gasoline vapor caused to decreased spermatogonia in seminiferous tubules. In accordance with our findings, studies indicate that results suggest that some components of gasoline – in particular Ethyl Tertiary-Butyl Ether (ETBT) - appear to be capable to negatively alter the reproductive steroid levels [8]. However, in contrast to our finding some studies have shown that there were no specific effects on reproduction development following exposure to some components of gasoline – specially ETBT - in rats [9]. On the other hand, studies show that topical exposure of gasoline causes some deleterious effects on skin and extracutaneous tissues [10]. Also, some sperm parameters were altered in rats exposed to low or moderate lead concentrations [11]. The reports have indicated that gasoline vapor condensate (GVMC) inhalation caused an increased trend for testicular tumors [12]. It has also long been shown that lead could affect the male reproductive function in rats [13]. However, t-butyl alcohol which is a common gasoline additive, produced no adverse effects on reproductive parameters in male or female rats or mice [14].

V. CONCLUSION

Our findings show that inhalation of gasoline vapor has adverse effects on male reproductive system.

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REFERENCES