ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 11, pp.61185-61188, November, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

EFFECTS OF LONG TERM EXPOSURE ASSESSMENT OF BENZENE IN PETROL PUMP WORKERS

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ARTICLE INFO

Article History:
Received 27th August, 2017
Received in revised form
29th September, 2017
Accepted 09th October, 2017
Published online 30th November, 2017

Key words:
Petrol pump workers,
Oxidative stress,
Antioxidants,
Liver enzymes.

ABSTRACT

Background: Petrol pump workers constantly inhale polluted air and fumes of petrol in their duties. Liver injury had long known to be associated with occupational exposure to a wide range of chemicals. Benzene affects many enzyme activities in the liver, tissues, and peripheral blood and this can lead to a decrease in the activity of antioxidants enzymes and may result in oxidative stress.
Aim: To study the effects of petrol fumes on the liver enzymes and other biochemical parameters on petrol-pump workers.
Material and Method: 50 workers at Petrol pump stations and 50 service workers not exposed to Benzene were selected for study. Study consisted of quessionaire, and blood investigations for MDA, SOD and liver enzymes AST, ALT and ALP. Statistical analysis done by student t test.
Result: MDA, SOD and all liver enzyme levels of exposed group were found to be significantly high as compared to non-exposed group.
Conclusion: Occupational exposure to benzene found to have hazardous effects on parameters of oxidative stress and antioxidants along with the liver enzymes.

Citation: ***Shrirang Holkar, Deepali Vaishnav and Manjusha Hivre, 2017.*** "*Effects of long term exposure assessment of benzene in petrol pump workers*", *International Journal of Current Research*, 9, (11), 61185-61188.

INTRODUCTION

Air pollution is considered as major hazard of rapidly increasing urbanization throughout the world including India. Increasing number of vehicles with emission of burnt fuels (petrol and diesel) is major cause of air pollution in most towns and cities. Exposure to air pollutants for longer duration (in years) results in hazardous effects on the parameters of body fluids (Donaldson *et al.,* 2006). Petrol pump workers constantly inhale polluted air and fumes of petrol in duties ranging from 8-12 hours at petrol pump stations. Petrol is a mixture of volatile hydrocarbons, whereas diesel is distillate of petroleum which contains paraffin, alkenes and aromatics[1]. Petrol and diesel after combustion in automobile engines give rise to particles which are highly respirable and can cause significant health problem (Singhal *et al.,* 2007; Uzma *et al.,* 2008). So this group of workers is likely to have grave ill effects on their health (Salvi *et al.,* 1999). Liver injury had long known to be associated with occupational exposure to a wide range of chemicals. They can get deposited in large numbers and deeper into the liver since it is the primary organ for the biotransformation of chemicals within the body (Wichmann, 2007). Such metabolism is always associated with the disturbance of hepatic biochemistry and generation of reactive oxygen species (ROS) (Fernandez-Checa, 2005) which are assumed to induce oxidative damage on liver, kidney and hematopoietic system. Benzene affects many enzyme activities in the liver, tissues, and peripheral blood and this can lead to a decrease in the activity of antioxidants enzymes and may result in oxidative stress (Scandalios, 2005). This study was undertaken to study the effects of petrol fumes on the liver enzymes and other biochemical parameters on petrol-pump workers in Aurangabad district.

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MATERIALS AND METHODS

The study was conducted in Department of Biochemistry during the period-Jan 2017 to June 2017. Approval from Institutional Ethical Committee (IAC) was taken before start of the study. The subjects selected for the study were the workers at various petrol pumps, in Aurangabad. The study consisted of two groups:

Group I (Exposed group): It included 50 workers at Petrol pump stations in Aurangabad City exposed to Benzene on performing their job and,

Group II (Non-exposed group): It included 50 service workers not exposed to Benzene at their current occupation nor even had a past occupational history of exposure to Benzene. Also known as control group.

Both exposed and control group were comparable as regards to sex (all were males) and age.

Table 1. Demographic characteristics of petrol pump workers and controls

Socio demographic characteristics & Living conditions	Group I (Exposed) (n=50) (%)	Group II (Non-exposed) (n=50) (%)
1.Age	39.53 ± 6.37	36.82 ± 6.11
2.Gender		
Male	50 (100%)	50 (100%)
3.Marital status		
Married	37 (74 %)	34 (68%)
Unmarried	13 (26%)	16 (32%)
4.Level of education		
Illiterate	10 (20%)	5 (10%)
Only read and write	12 (24%)	11 (22%)
School education	24 (48%)	21 (42%)
Higher education	4 (8%)	13 (26%)
5.Residence		
Urban	27 (54%)	29 (58%)
Rural	23 (46%)	21 (42%)
6.Smoking		
Yes	33 (66%)	35 (70%)
No	17 (34%)	15 (30%)
7.Alcohol consumption		
Yes	39 (78%)	33(66%)
No	11 (22%)	17(34%)
8.Living in high polluted area		
Yes	34(68%)	29(58%)
No	16(32%)	21(42%)
Work environment		
1.Level of stress in your job		
Mild	14(28%)	21(42%)
Moderate	36(72%)	29(58%)
2.Years of exposure to harmful chemical substances/ duration of employment		-
5 or <5 years	10(20%)	
5-10years	16(38%)	
> 10 years	24(48%)	
3.Daily exposure in hours	9.7±1.2	-
Health conditions		
1.Having allergic tendencies		
Yes	28(56%)	23(46%)
No	22(44%)	27(54%)
2.Suffering from infections		
Yes	21(42%)	16(32%)
No	29(58%)	34(68%)

Inclusion criteria

All exposed were male workers in Aurangabad city, none of the workers included in this study had known exposure in any industry directly involved with benzene other than their current work. The subjects were apparently healthy between the age group of 25-55 years, with a minimum exposure of six months. The controls on the other hand were also males employed away from the petrol pumps and healthy. They were between 25 and 55 years with no exposure to petroleum fumes and matched for lifestyle with exposed workers. A detail history was recorded which included questions regarding duration of work at petrol pumps, smoking habits, present respiratory symptoms if any, past history of respiratory/cardiac disease. The workers having past history of respiratory or cardiac disease were excluded from the study. A structured questionnaire was used to collect information from all participants. Serum level of MDA was measured according to the method of Ohkawa et al. [8]. The reference range of MDA was 0.12 - 1.71 nmol/ml. The activity of SOD was assayed by the method developed by Kakkar (Kakkar *et al.,* 1984). The reference range of SOD was 0.16 – 0.24 u/l. Liver enzymes ALT(Alanine Transaminase), AST (Aspartate Tranaminase) and ALP (Alkaline Phosphatase) were estimated using Vitros 5600 automated analyser. Statistical analysis was carried out after summarizing the data by computing mean and standard deviation (SD) of each study variable. Student t test was applied to compare the findings between exposed group and non-exposed group.

RESULTS

Results of this study showed that the exposed and control groups are comparable regarding age, marital status, the level of education and residence, living conditions and smoking, alcohol habits (Table 1). This table also shows that the level of stress was significantly moderate amongst both the groups. Almost 48% of the exposed group were working for >10 years at the petrol pump station. The mean daily exposure of all exposed group workers was found to be 9.7 hours. Figure 1 shows (mean±SD) MDA levels of exposed group (4.84±1.62) which was found to be significantly high as compared to non-exposed (1.36±1.27) group (p=0.0005). Similarly, figure 2 shows (mean±SD) SOD levels of exposed group (0.90±0.64) which was found to be significantly low as compared to non-exposed (1.42±0.54) group (p=0.001).

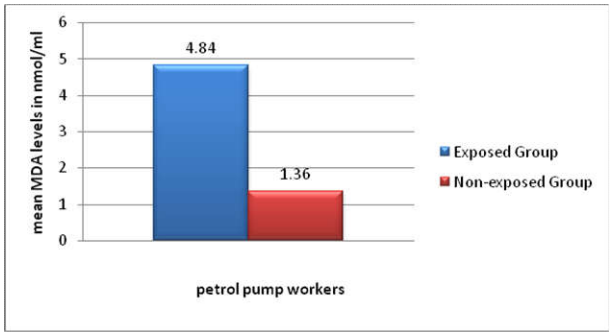

Figure 1. Mean MDA levels in exposed and Non-exposed groups

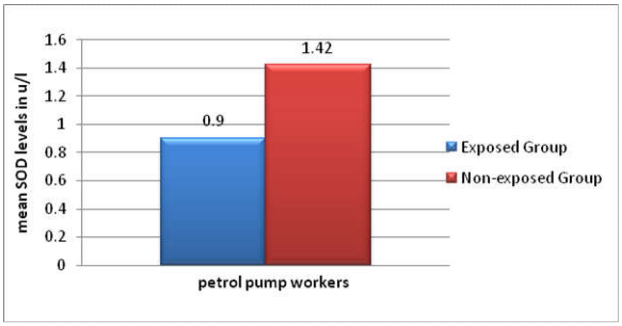

Figure 2. Mean SOD levels in exposed and Non-exposed groups

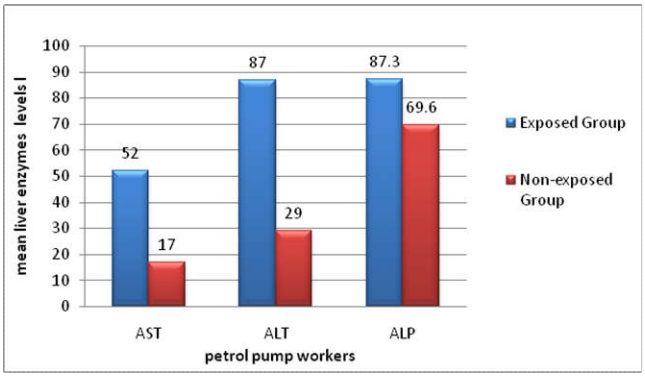

Figure 3. Mean liver enzyme levels in exposed and Non-exposed groups

The mean values of liver enzymes AST, ALT and ALP are shown in figure 3 which are significantly raised in exposed group.

DISCUSSION

Oxidative stress is defined as a disequilibrium between pro-oxidant and anti-oxidant systems, Plasma Malondialdehyde (MDA) is a biological marker of lipid peroxidation resulting from oxidative stress (Pan *et al.,* 2008). Human body is equipped with various antioxidants like superoxide dismutase (SOD) and catalase (CAT) which can counteract the deleterious action of ROS and protect from cellular and molecular damage (Winn, 2003). This study showed high statistical significant difference among exposed group compared to control group regarding the level Malondialdehyde (MDA) which was higher among exposed**.** This is in agreement with other studies which illustrated that Benzene exposure has been associated with increase in the overall formation of MDA (Chen, 1992; Georgieva *et al.,* 2002) also this study is consistent with other studies which found a significant increase in the level of MDA in petrol station workers compared to their control group (Uzma *et al.,* 2010; Emara, 2008; Kum *et al.,* 2007; Karagozler *et al.,* 2002; Moro *et al.,* 2013). Results of this study showed that the level of superoxide dismutase (SOD) is lower among exposed group. This is consistent with other studies which showed that the activity of SOD were significantly lower in workers exposed to Benzene compared to control group (Moro *et al.,* 2013), also other studies (Uzma *et al.,* 2010; Kum *et al.,* 2007; Karagozler, 2002) found that SOD was significantly decreased in the Petrol filling workers compared to control group. Chen [12] also reported that benzene exposure decreases the level of serum SOD in humans. Rekhadevi et al. (2010) also reported decreased level of SOD in filling station attendants exposed to petroleum Hydrocarbons. Enzymes are useful bio-markers used in assessing specific functions and integrity of a cell, especially hepatocytes. An increase levels in these enzymes activities in the plasma are linked to hepatocellular damage caused by either toxins, toxins in drugs or herbs (Cheesbrough, 1999). This study was conducted to assess the level exposure to this product and the possible damage caused to the liver among petrol pump workers. There is a significant increase in the levels of plasma liver enzyme such as aspartate aminotransferase, alanine aminotransferase and alkaline phosphatase in petrol pump workers when compared with control subjects. This agrees with the findings of Duricic (Duricic, 1991) who reported that there are degenerative changes in hepatic and renal functions when exposed to petrol, it is also in consonant with the findings of Dede and Kagbo (Dede, 2001) which reported a dose dependent hepatocytes necrosis in rat fed in diesel fuel contaminated source. The alanine aminotransferase (ALT) and aspartate aminotransferase (AST) are the most commonly measured enzymes that detect hepatocellular injury due to the toxicant's effect on all or part of the hepatocyte, including the cell membrane (Douidar *et al.,* 1992).

Conclusion

From the results of this study, we concluded that occupational exposure to benzene found to have hazardous effects on parameters of oxidative stress and antioxidants along with the liver enzymes. Benzene and its metabolites induce oxidative stress which was noticed by the results of the study that showed increased level of MDA and decreased antioxidants activity among the petrol station workers and this plays a role in benzene-initiated toxicity. A further study should be carried out on the duration and route of exposure such as inhalation, mouth, and dermal to ascertain the effect of the substance, which might also be a major contributing factor and causes health hazard.

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