Biological Forum – An International Journal **10(2): 28-32(2018)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Comparative Study of the Blood Lead Level among Outdoor and Indoor Traffic Police Sergeants in Quetta City of Pakistan

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(Received 09 May 2018, Accepted 25 July, 2018)
(Published by Research Trend, Website: www.researchtrend.net)

ABSTRACT: Lead is a toxic chemical element whose wide spread use has caused health and environmental issues all over the globe. It is a heavy metal that is denser than most common materials. This study was conducted in Quetta city to estimate lead level in blood of Traffic Police Sergeants (TPS) with outdoor job description and its effect on their health. To assess the socioeconomic and health conditions of traffic sergeants a detailed questionnaire was formulated. Blood samples were collected from 248 male traffic police sergeants, 20 to 50 years of age, performing duties for almost 8 hours a day in different zones of Quetta city and had been controlling traffic from 5 months to 25 years. Blood lead level (BLL) was estimated by using Atomic Absorption Spectrophotometer. BLL of indoor traffic police sergeants ranged in between 20-30 ug/dL whereas BLL of outdoor traffic police sergeants ranged in between 30-40 ug/dL. Since traffic sergeants with outdoor job responsibilities were exposed to vehicular exhaust on regular basis, therefore, the chi test depicts significant blood lead level difference among them i.e ($p<0.05$) depicting outdoor TPS at brink of lead toxicity/health issues.

Keywords: Blood Lead Level, lead, health, Quetta, Traffic sergeants

How to cite this article: Nelofer Jamil, Sadaf Ashraf, Heera Anum, Mohammad Bilal, Ambreen, Naeem Shahwani, Sunbal Siddique and Ayesha Ubaid (2018). Comparative Study of the Blood Lead Level among Outdoor and Indoor Traffic Police Sergeants in Quetta City of Pakistan. *Biological Forum – An International Journal*, **10**(2): 28-32(2018).

INTRODUCTION

Lead was one of the earliest metals discovered by the human race and was in use by 3000 B.C. One can easily conclude that industrialization has caused intensive and reckless lead usage causing serious threat to every human being. The major environmental sources of lead exposure include, air, dust, soil, drinking water and food contaminated with lead (WHO, 1996). Tentatively, Blood Lead Level (BLL) in any bodily fluid should be zero, which virtually is not possible in current industrial era (Marcus, 1986). Few amongst us like; traffic sergeants (Agha *et al.,* 2005), individuals working at petrol pumps (Al-Rudainy., 2010; Tayrab *et al.,* 2016,), auto mobile mechanics and street occupation people along general public/jobless (Yakub and Iqbal, 2010) are further exposed to this toxic agent.

Many variables in the absorption, storage and excretion of lead, modify the BLL in the body, and therefore its effects (Goldstein *et al.*, 1974). It is a toxic metal and can affect multiple body systems such as neurological, gastrointestinal, reproduction and cardiovascular (Singh *et al.*, 2010). Lead poisoning accounts for about 0.6% of the global burden of disease (WHO, 2009).

Historically, BLL is estimated to have been way less than today. Bone lead measurements from two Native American populations of Pacific coast and the Colorado River living between 1000-1300 A.D. i.e before industrial revolution, showed BLLs of approx. 0.016 µg/dL (Harris and Harper, 2001). The World Health Organization and others interpret these measurements to be broadly representative of human preindustrial BLL (Tong *et al.,* 2000).

Contemporary human BLLs in remote locations are estimated to be 0.8 and 3.2 µg/dL in the southern and northern hemispheres, respectively (Harris and Harper, 2001). Blood lead levels 50 to 1,000 times higher than preindustrial levels are commonly measured in contemporary human populations around the world (Tong *et al.,* 2000). In 2000, around 120 million people around the world had blood lead concentration of between 5 and 10 ug/dL and about the same number had concentration of >10 ug/dL. For normal human being acceptable limit of lead was 10g/dL in 2000. Similarly, in South Africa 4 million people had level of lead in blood greater than 10lg/dL (Beckley *et al.,* 2018).

Advance/developed countries have taken realistic measures, such as; source identification, monitoring and improvements in industrial methods to reduce occupational lead exposure by putting ban on the usage of lead content products. However, on the other hand, developing countries like Pakistan, India and numerous African countries have not even banned lead in petrol (http://www.worldbank.org/ html/extdr/extme/gaspr.htm 2000). These countries could be at alarming point due to either little or no concern about environmental along health issues. Although in these countries lead is considered a health hazard, still lot is required to be done. Similarly, only a few studies highlight the extent of BLL in Pakistan providing less estimation about its toxicity. Since lead toxicity danger is enhanced due to unawareness about its symptoms and the only source to determine lead level is through blood, we hypothesized that the outdoor traffic police sergeants working without taking any precautionary measures are exposed to lead (through inhalation, dermal contact etc) for approximately one third part of the day and hence must be at the brink of lead poisoning. Present study aims to compare blood lead level among outdoor and indoor traffic police sergeants.

MATERIALS AND METHODS

A. Area description

Quetta is capital city of Balochistan which is located 1676.4 m above the sea level and its latitude is 30 degree 12’ 0” N and Longitude is 67 Degree 6’ 0” E. Research is carried out in the month of November-December, when average temperature in city is around 3 to -1°C degree. There are very small number of people who have some knowledge about damaging effect of lead on our health, especially drivers, transporters etc. who are all time engaged. There is a need to take concrete steps against this potential killer on war footings (Khwaja and Khan, 2005).

B. Demographic

Present study used purposive sampling technique (non-probability) and was conducted in Quetta city, Pakistan from October-November 2014, during which constables, SP and SSP offices were visited. The study population was divided into two categories; Indoor traffic police sergeants & Outdoor traffic police sergeants. Sample size was 248 out of which, 124 were out door and 124 were indoor traffic police sergeants that were performing duties in different zones of Quetta city. The targeted subjects were of ages from 20 to 50 years, job duration was from 5 months to 25 years and job timings were eight hours to eighteen hours per day. Officers who had any blood disorder for instance; haemophilia, thalassaemia, etc., were not sampled.

C. Questionare and health data

An already designed questionnaire was provided based on specific information related to age, socioeconomic status, health status and physiological status. Correlation coefficient was applied to find out the significant difference between outdoor (OD) and indoor (ID) subjects.

D. Blood sampling

Approximately 5.0 ml of venous blood was collected from each subject through sterilized syringes which was quickly transferred to test tubes already containing EDTA (ethylene diamine tetra acetic acid) and was properly secured and labeled. From this extract, one ml of blood with 0.5ml of HNO_3 was taken in volumetric flask and was dried on hot plate for 3 hours at 30°Ċ until the powder was obtained then it was mixed with distilled water and then filtered and labeled. Filtrate was transferred into conical flask and made the volume up to 50ml. The extracts were finally transported to laboratory of Pakistan council of science and industrial research (PCSIR). The blood samples were analyzed by atomic absorption spectrophotometer.

Informed consent was obtained from the respective head of the department before ensuring their participation in the study, in accordance with the ethical standards. The sergeants names, initials, or any other personal information were not used in any way whatsoever.

E. Statistical analysis

SPSS 24 was used for data analysis. Microsoft Excel 2007 was used to construct graphs and tables. BLL was compared to other variables using Pearson's chi-square test. A p-value of 0.05 was considered significant.

RESULTS

A. Chi-Square Tests

Blood Lead Level of indoor traffic police sergeants ranged in between 20-30 ug/dL whereas BLL of outdoor traffic police sergeants ranged in between 30-40 ug/dL.

Out of total population (248), 75% Indoors workers had lead levels up to 20µ g/dL; while remaining 25% cases had lead levels ranging from 20-30 µ g/dL. However, outdoor workers' mean blood lead level was significantly high. In 34% outdoors cases, the blood lead level was higher than 40 µ g/dL; while 66% cases had blood lead level ranging in between 30-40 µg/dL.

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	55.500[a]	**247**	.456
Likelihood Ratio	46.142	**247**	.797
Linear-by-Linear Association	2.068	**1**	.150
N of Valid Cases	248		

a. 72 cells (100.0%) have expected count less than 5.
b. The minimum expected count is 0.08.

The entire questionnaire was divided in four (03) sections as follows;

Section-A: Demographic Details

Participant's demographic detail was covered in this section including names, age, gender and qualification, marital status, duty timings, duration of job, area of duty.

Section-B: Psychological status

The psychological status of both groups was found to be very bad but it had been recorded as alarming in case of OD traffic police sergeants. The identified factors were the general public behavior and job timings which sometimes exceeds up to more than 18hours (Table 1).

Section C: Effect on health

Outdoor traffic police sergeants (TPS) had significant health issues as compared to indoor TPS. Ng from body weakness was recorded as 80% and 20% for OD and ID respectively. While memory loss, body pain, headache and hearing loss were found to be 82 and 40%, 84 and 38%, 100 and 45% and 88 and 26% in case of OD and ID correspondingly (Table 2).

Table 1: Level of satisfaction in OD and ID subjects.

Factors	OD (%)		ID (%)	
	Satisfied	Not Satisfied	Satisfied	Not Satisfied
General public behavior	92	08	65	35
Job timings	85	15	66	34

Table 2: Symptoms of lead poisoning in OD and ID subjects.

Symptoms of lead poisoning	OD (%)	ID (%)
Weakness	80	20
Memory loss	82	40
Body pain	84	38
Headache	100	45
Role Hearing threshold	88	26

DISCUSSION

Lead is a heavy metal, a "silent killer" and is responsible for 143,000 deaths as well as 600,000 cases of mental disabilities each year (WHO, 2015). Theoretically, no living body can have zero level of lead in it especially in this industrial age. Although lead has been phased out in petrol, paints etc in developed countries, still under developed and developed countries have not defined any mechanism to either cut short its level or phase it out. Unluckily, socio-economic issues of Pakistan, and the incidence of widespread treatable diseases have never been paid much attention (Afridi *et al.,* 2016).

Therefore, this study is being conducted with the hope that government shall take in consideration the health status of street occupation people with respect to lead exposure. In this study we measured BLL of outdoor traffic police sergeants and compared them with indoor traffic police sergeants. For this purpose, high officials of the sergeants were briefed regarding the study. Sergeants having any blood disease or exposure to lead through any other major source (like printing) were excluded. Blood samples were collected and analyzed. The findings of the current study showed that BLL of outdoor traffic police sergeants was significantly higher than indoor traffic police sergeants.

The best possible reason could be owing to inhalation of airborne lead since they ignored to use personal protection equipment's like; facemasks, and through dermal absorption (gloves) during duty timing. Another possible reason could be that in Pakistan, the main source of lead pollution is vehicle fumes containing lead particles. Similarly, the significant difference of mean blood lead level among outdoor and indoor traffic police sergeants could also be associated with longer lead exposure duration. Results are in agreement with the findings of Sadruddin *et al*. 1992) and Al-Rudainy, 2010) where fuel station workers also had higher blood lead levels.

The outdoor workers were suffering more from psychological and health hazards as compared to indoor subjects. Similar results were reported by Sharif *et al.* (2009) and Sharma *et al.* (2015). The health status of TPS should be improved so that they may use personal protection equipment's while performing their duties in order to prevent themselves from respiratory, dermal contact with lead as proposed by Morgan *et al*. (1990) and Mushak, (1989 & 1992). Similarly, Police department is not rewarded at any level as compared to other professions. Public behavior, job timings/stress, life threats and respect in case of TPS is quite worst (Naik 2012).

CONCLUSION

Lead was found in the blood of outdoor traffic sergeants and was significantly related to the place of residence. Although Health education and training is fundamental tool to prevent occupational diseases, measures taken by the relevant authorities in Pakistan to control this problem were found to be insufficient. Stern actions are needed to reduce the use of lead in industries, which may be the source to an increase in the levels of lead in the environment and thus in the blood of our future generations. It is therefore essential to develop strategies to decrease lead pollution by introducing lead free petrol, banning Irani petrol, providing safety equipment and introducing CNG in vehicles.

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