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Analysis of Blood lead levels among Petrol Pump Workers in Bhopal city, India

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Abstract

In this research paper, detail study about the blood lead level (BLL) among petrol pump workers of the Bhopal city was described. To study the blood lead level among petrol pump workers in Bhopal city, BLL was determined experimentally by taking the blood sample of 26 peoples with a varying age group from 18 years to 66 years. It was observed that BLL was on the higher side for the peoples working in the petrol pumps. The effects of different factors on the estimated BLL of individuals in the present investigation have been comprehended and are elucidated in terms of descriptive statistics such as means and standard errors including lower and upper bound 95% confidence intervals (CI). It was found that the BLL were 97.61±3.07 µg/dl with the lower and upper bound 95% confidence intervals for means being 91.28 to 103.93, µg/dl in the individuals working at petrol pumps.

Keywords: Confidence intervals, blood, investigation, lead, petrol.

Introduction

Accumulation of trace metals in human body due to degradation of environment is great concern for the society[1]. Metals like lead and cadmium are believed to non-essential and can cause harmful effect by chemical and neurological changes in the human body even at ultra-trace level[2]. Continuous exposures to lead results in gradual accumulation in the body and elevated levels of lead have been observed in many tissues and fluids[3, 4]. Metals like lead is taken up into the blood cells have chemical bonded to haemoglobin. It has been reported by many authors whole – blood is the most reliable parameter for assessment of exposure of trace metal like lead, copper etc. in occupational as well as general population[3-7]. Keeping this into mind, blood lead level (BLL) for petrol pump workers of Bhopal city was studied by computing the lead contents in the human blood through experimentation. Lead is a natural constituent of earth's crust, but once mined and transformed in to man made products, lead becomes highly toxic[8]. The present study was undertaken to investigate the blood lead levels (BLL) in the individuals of Bhopal city with the primary objective of ascertaining the influence of various factors viz., duration of exposure, age, area of dwelling andsmoking and liquor habits on the vulnerability of people working in the petrol filling stations to lead toxicity.

Material and Methods

Collection of blood sample: To carry out the present study, the blood samples were collected from 26 individuals by visiting the petrol pumps located in Bhopal city at different areas. Approximately 10 ml of blood was collected from each individual by means of with sterilized or disposable syringes, equipped with stainless steel tips which were used once only. Immediately after collection, the blood was transferred inSSTs (Serum Separation test tube). After transferring the blood into the tube, the blood was centrifuged into the serum and the blood cells with the help of the centrifugal machine. Then the serum was separated from the blood cells. Both the serum and the blood cells were stored in the refrigerator at 4 to 6°C till further analysis. Additional information, such as the working area, duration of working in the petrol pumps, age and drinking and smoking habits of the donors were recorded as shown in Table1. On the basis of information, the individuals were classified according to their age into three groups, viz., age group-I (15 to 30 years), age group-II (31 to 45 years) and age group-III (above 45 years). Similarly, the sampled individuals were classified on the basis of time of exposure of working in the petrol pumps into three different groups; group-I (1 to 10 years), group-II (11 to 20 years) and group-III (above 20 years).

Preparation of sample and estimation of lead in the blood: For the determination of the lead content in the blood, the solution was prepared as per the method adopted by Subramanian[9]. Using an Eppendorf micro pipette, one ml of blood sample was transferred into 10 ml polystyrene tube. Then 0.5 ml of concentrated nitric acid was mixed and it was digested in mantle heater at 30°C till it became dry. After cooling, the powder obtained was mixed with distilled water and filtered with Whatman filter paper. Filtered solutions were transferred into measuring cylinder and the volume of the solution was made to 50 ml by adding the distilled water. This solution was

used for estimation of blood lead level through ECIL'S Atomic Absorption Spectrophotometer (AAS-4141).

Statistical analysis of data: The data were analysed by statistical software SPSS version-18. The univariate Analysis of Variance (ANOVA) was carried out to find out whether the BLL among individuals in sub-groups within different categorical variables statistically differed significantly from each other or not. The pairwise mean comparisons between sub-groups were made by Critical Difference (CD) value.

Results and Discussion

To study the lead pollution among the individuals working at petrol pumps in the Bhopal city, BLL was determined experimentally by collecting the blood samples of 26 peoples of different age varying from 18 to 66 years. The effects of different factors on the estimated BLL of individuals in the present investigation have been comprehended and are elucidated in terms of descriptive statistics such as means and standard errors including lower and upper bound 95% confidence intervals (CI). Further, the results of data subjected to Analysis of Variance (ANOVA) together with the comparison of means for statistical significance of differences between sub-classes under each category of classifications are also elaborated to throw light on the truth or falsity of the null hypothesis that assumes no significant differences in the mean BLL of individuals of various groups within a classification. The number of observations, means, standard errors and 95% confidence interval for mean in the individuals of different categories is presented in the table-2. As 95% of the lead in blood is bound to the erythrocytes, this is considered to be the best indicator of individual exposure[10].

Table-1
Detail of Individuals for Blood Sample Collection

Worker	Duration (Yrs)	Age (Yrs)	M/F	Veg/ Nonveg	S/NS	A/NA	Working Area	BLL(µg/dL)
Filling of Petrol	01	18	M	Both	NS	NA	TIN shed	**82.5**
Filling of petrol	03	21	M	Both	NS	NA	TIN shed	**90.6**
Filling of petrol	20	48	M	Both	S(20yrs)	A(20yrs)	TIN shed	**98.4**
Filling of Petrol	12	20	M	Both	S	A	Royal Market	**90.9**
Filling of Petrol	03	19	M	Both	S (3 yrs)	NA	Royal Market	**89.6**
Manager in PP	10	29	M	Both	S(05yrs)	A(05yrs)	Royal Market	**64.9**
Cashier PP	09	22	M	Both	S(02yrs)	A(02yrs)	Royal Market	**64.1**
Filling of petrol pump	17	45	M	Both	S(02yrs)	NA	Royal Market	**99.8**
Filling of petrol pump	15	35	M	Both	S(05yrs)	NA	Royal Market	**111**
Sales Manager in PP	15	30	M	Both	S(10yrs)	NA	Royal Market	**106.2**
Filling of petrol pump	25	36	M	Both	S(15yrs)	A(15yrs)	Royal Market	**119.2**
Sales Manager in PP	24	54	M	Both	S(25yrs)	A(25yrs)	Royal Market	**127.1**
Sales man in PP	23	35	M	Both	NS	NS	Royal Market	**98.6**
Manager in PP	30	48	M	Both	S(30yrs)	A(30yrs)	Royal Market	**99.5**
Petrol filling	15	42	M	Both	S(10yrs)	NA	Royal Market	**111.2**
Salesman in PP	16	47	M	Both	S(20yrs)	NA	Royal Market	**99.6**
Accountant in PP	06	76	M	Both	NS	NA	Royal Market	**75.4**
Petrol filling	2.5	20	M	Both	S(o5yrs)	NA	Royal Market	**82.8**
Manager in PP	21	45	M	Both	S(20yrs)	NA	Royal Market	**91**
Cashier/filling in PP	10	25	M	Both	S(10yrs)	A(10yrs)	Royal Market	**94**
Petrol filling	04	36	M	Both	S(15yrs)	NA	Royal Market	**108.5**
Petrol filling	20	41	M	Both	NS	NA	Alpanatiraha	**115.9**
Petrol filling	25	57	M	Both	NS	NA	Alpanatiraha	**112.1**
Petrol filling	09	30	M	Both	NS	NA	Alpanatiraha	**100.4**
Petrol filling	03	32	M	Both	S(05yrs)	NA	Alpanatiraha	**100.5**
Manager in PP	52	66	M	Both	NS	NA	Alpanatiraha	**114.2**

Abbreviations used in the above Table are: NS- Non Smoker, NA- Non Alcoholic, A- Alcoholic, M-Male, F-Female, PP- Petrol pump.

Blood lead levels in individuals of different age groups: The means ± standard errors of BLL were found to be 86.60±4.32, 106.19±3.07 and 103.76±6.16 µg/dl in the individuals of age groups I, II and III, respectively. The analysis of variance revealed that calculated F-value was highly significant ($p \leq 0.01$). The mean BLL in the age group-I, which comprised of individuals between 15 to 30 years, was significantly lower than BLL in the individuals of other two age groups. There was, however, no significant difference between BLL of individuals of age groups-II and III. Variation of BLLfor age group is shown in figure 1.

Blood lead levels based upon durations of exposure: The average BLL in the individuals based upon their time of exposure by way of working in the petrol filling stations were estimated to be 86.66±4.35, 104.13±2.95 and 108.81±4.86 µg/dl in the work exposure groups I, II and III, respectively. The means of BLL showed a progressive increase with the increase in the time of exposure of working in the petrol pumps. This is also graphically shown in figure 2. This led us to conclude that an increase in the accumulation of lead in the blood of petrol pump workers depended upon the duration of exposure in the petrol filling stations. Thus, it is evident that the persons of professions in petrol pumps have more elevated BLL. Similar findings are also reported by Clausen and Rastogi[11] and Freije and Dairi[12]. The result of ANOVA for BLL by the time of exposure was very similar to that observed for the age groups.

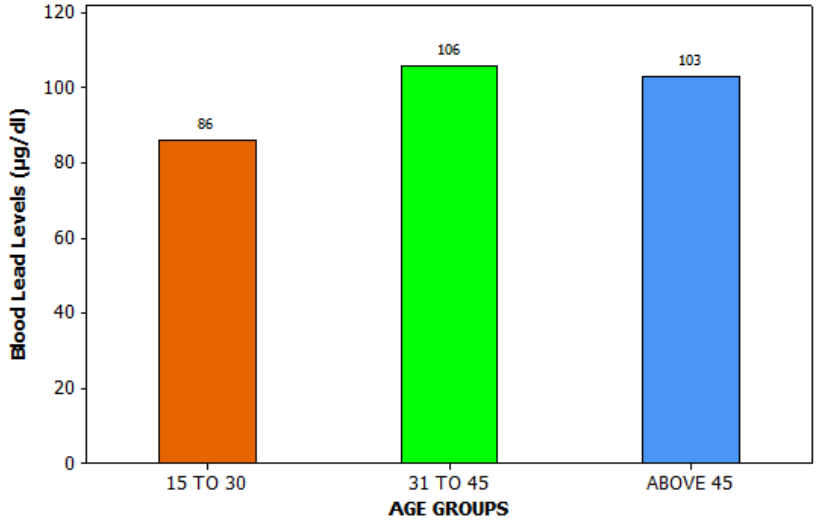

Figure-1
BLL of different age group

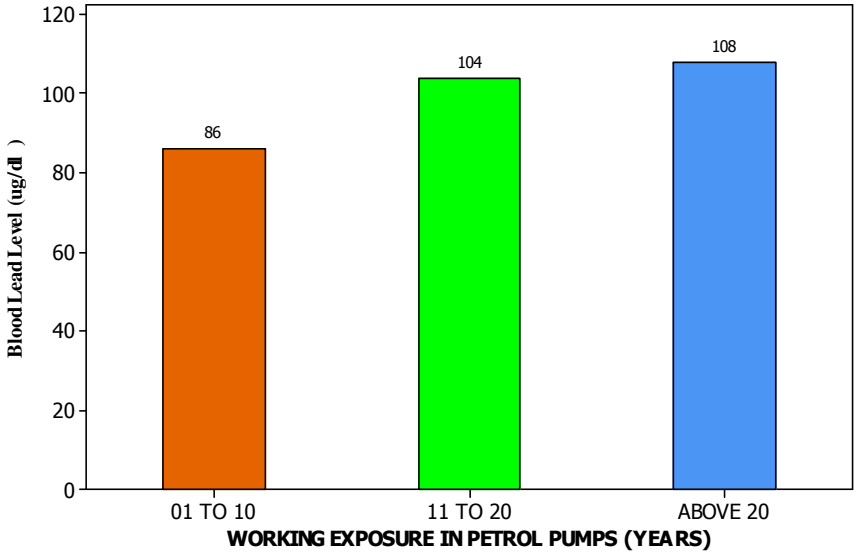

Figure-2
BLL based upon durations of exposure

Blood lead levels in individuals of different areas: The mean ± standard errors of BLL in the individuals in the present study were found to be in the ascending order of 90.50±4.59, 96.30±4.02 and 108.62±3.39 µg/dl in theresidential areas I (Tin-shed), II (Royal Market) and III (AlpanaTiraha), respectively as shown in figure 3. The higher increase in the BLL of individuals residing near AlpanaTiraha may be attributed to heavy vehicular traffic leading to more emission of lead in the environment as compared to AlpanaTiraha and Royal Market areas.

Blood lead levels in individuals by smoking and liquor habits: The BLL were also determined in the individuals with and without the habits of smoking and liquor consumption. The mean BLL in this study were estimated to be 98.71±5.33 and 97.68±3.83 µg/dl in the non-smoking and smoking individuals, respectively. The corresponding estimates of BLL in the non-alcoholic and alcoholic individuals were 99.44±2.82 and 94.76±7.94 µg/dl. It indicates that BLL for alcoholic person is lesser as compared to non alcoholic person. Similar finding was reported by Barltrop and Meek [13] and Barltrop and Khoo[14].

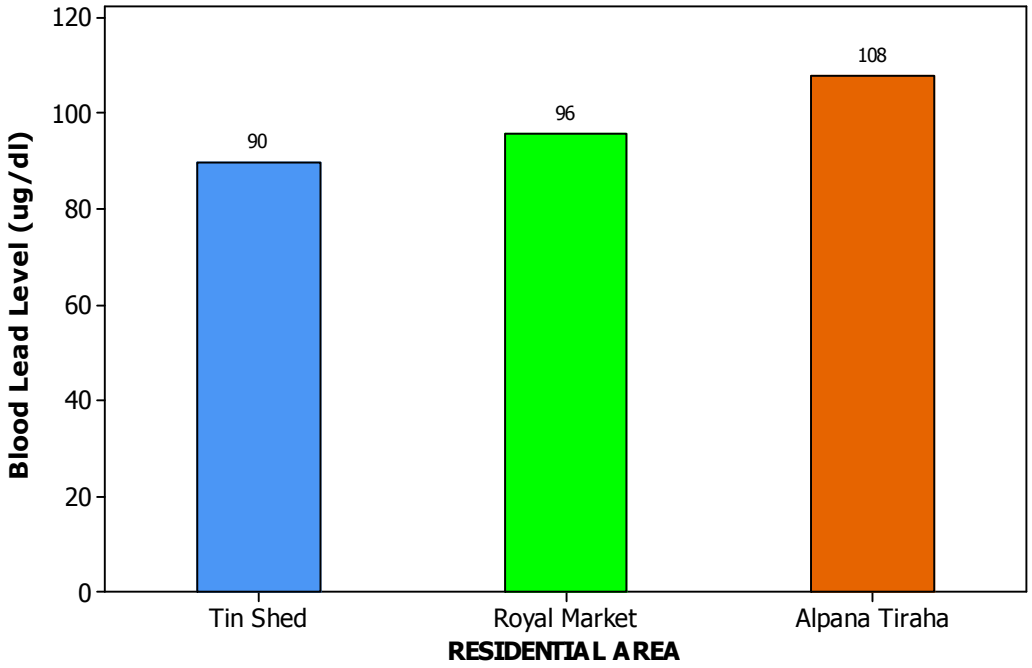

Figure-3
BLL in individuals of different areas

Table-2
Mean, Standard Errors and 95% Confidence Intervals of Blood Lead levels (µg/dl)

Factor		N	Mean	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Age Groups	I	10	86.60	4.32	76.82	96.38
	II	9	106.19[a]	3.07	99.11	113.27
	III	7	103.76[a]	6.16	88.69	118.82
Duration of Exposure	I	11	86.66	4.35	76.98	96.35
	II	8	104.13[a]	2.95	97.15	111.10
	III	7	108.81[a]	4.86	96.93	120.70
Residential Area	I	3	90.50[a]	4.59	70.75	110.25
	II	18	96.30[a]	4.02	87.82	104.78
	III	5	108.62[a]	3.39	99.21	118.03
Smoking Habit	1	8	98.71[a]	5.33	86.12	111.31
	2	18	97.68[a]	3.83	89.60	105.77
Liquor Habit	1	18	99.44[a]	2.82	93.48	105.40
	2	8	94.76[a]	7.94	76.00	113.53

Note: Means having same superscript within a factor did not differ significantly from each other (p≥0.05)

Conclusion

To study the blood lead level among petrol pump workers in Bhopal city, BLL was determined experimentally by taking the blood sample of peoples with a varying age group from 18 years to 66 years. It was observed that BLL was on the higher side for the peoples working in the petrol pumps. The effects of different factors on the estimated BLL of individuals in the present investigation have been comprehended and are elucidated in terms of descriptive statistics such as means and standard errors including lower and upper bound 95% confidence intervals (CI).

Since the main purpose of this study was to know the blood lead level of persons working in petrol pumps for Bhopal city, hence the blood samples were collected from 26 individuals. Based on the analysis, the means and standard errors of BLL in the persons are presented. It was found that the BLL were 97.61±3.07 µg/dl with the lower and upper bound 95% confidence intervals for means being 91.28 to 103.93, µg/dl in

the individuals working at petrol pumps. Thus, it is evident that the persons of professions in petrol pumps have more elevated BLL. Similar findings are also reported by Clausian and Rastogi[11] and Freije and Dairi[12]. Thus, it is concluded that petrol pump workers of Bhopal city is affected with lead pollution. As per WHO norms permissible BLL is 40 µg/dl for adults and 25 µg/dl for children, though it should be zero. In Bhopal city, industrial and urban development is taking place at a faster rate consequently the quality of our environment of Bhopal city is degrading. Combustion of oil and gasoline account for more than fifty percent of all anthropogenic emissions and thus form a global cycle of lead by which soil water and air are polluted. Past researchers [15,16] also reported the increased level of lead in water bodies around the Bhopal city. Normally lead in water results from industrial source, but urban run-off and atmospheric deposition significantly contribute total burden[17]. The main roots of exposure of lead are via ingestion or inhalation through food, drinking water, soil, dust and air. Chipped leaded paint also contributes to significant exposure of lead[18]. Due to these reasons, BLL in the peoples of Bhopal city working in petrol pumps are found to be on the higher side. There is a need at government level and at society level to identify lead affected peoples require continued innovation and persistence from both public health officials and lab professionals.

References

1. Seema Tiwari,Tripathi I.P.and TiwariH.L., Lead Poisoning –A Review, *Research Journal of Chemical Sciences,***3(8),** 86-88 **(2013)**

2. Nielsen F.H., Ultra Trace Elements in Human Nutrition A.R.Diss.Inc., NewYork, 379-404 **(1982)**

3. WHO, Recommended Health Based Limits in Occupational Exposure to Heavy Metals,*Tech. Rep.Ser.*, **647** WHO Geneva **(1980)**

4. Berman E., Toxic Metals and their Analysis *Heyden and Sons Ltd. London*, UK, **(1980)**

5. McaugheyJ.J. and Smith N.J., Automated Direct Chromium in Blood and Urine by Electrothermal Atomic Absorption Spectrometry, *Analytica Chemica Acta*, **193**, 137-146 **(1987)**

6. WibowoA.A., HerberR.F.M., Deyck W.Van and Zielhvis R.L., Biological Assessment of Exposure in Factories with Second Degree uses of Cadmium Compounds, *Int. Arch. Occup. Environ. Health,***49**, 265-273 **(1982)**

7. Patricia A.P. and Kart H.P., Determination of Lead in Whole Blood and Urine using Zeeman effect flame less Atomic Absorption Spectroscopy,*Anual Letters*, **12(58**), 935-950**(1979)**

8. Stoleski S., Bislimovska K.J., Stikova E., Kuc R.S., Mijakoski D.and Minov J., Adverse Effects in Workers Exposed to Inorganic lead,*Arh Hig Rada Toksikol*,**59**, 19-29**(2008)**

9. Subramanian K.S., Determination of lead in Blood Comparison of two GFAS methods,*At.Spectrosc*, **8,** 7-11**(1987)**

10. VahterM., Friberg L. and Lind B., Assessment of exposure to lead and cadmium through biological monitoring, *J. Am. Coll. Toxicol.,***1(3),** 117-127 **(1982)**

11. Clausen J. and Rastogi S.C., Heavy Metal Pollution among Autoworkers,*I. Lead British Journal of Industrial Medicine,***34**, 208-215**(1977)**

12. Freije M.A. and Dairi G., Determination of blood Lead Levels in Adult Bahraini Citizens Prior to the Introduction of Unleaded Gasoline and the Possible Effect of Elevated Blood Lead Levels on the Serum Immunoglobulin *Ig G Bahrain Medical Bulletin*, **31(1),** 47-52 **(2009)**

13. BarltropD. and Meek F.,Effect of Particle Size on Lead absorption from the gut,*Arch Environ Health*, **34,**280-285**(1979)**

14. Barltrop D. and Khoo H.E., The Influence of Nutritional Factors on Lead Absorption,*Post grade Med J.,***51,** 795-800**(1975)**

15. Upadhyaya, Anu and Bajpai, A. Heavy metal Analysis of Various Water Bodies Located in and around Bhopal, M.P.(India),*International Journal of Environmental Science and Development*, **2(1)**, 27-29 **(2011)**

16. Dixit S. and Tiwari S., Impact Assessment of Heavy Metal Pollution of Shahpura Lake, Bhopal, India,*Int. J. Environ. Res.*, **2(1),** 37-42 **(2007)**

17. EFSA (European Food Safety Authority). Panel on Contaminants in the Food Chain (CONTAM), Scientific Opinion on Lead in Food, *EFSA Journal,***8(4),** 1570 **(2010)**

18. WHO Trace elements in human nutrition and health,*World Health Organization,Geneva***(1995)**