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HEALTH RISK FACTORS IN LEAD POLLUTED ENVIRONMENT CAUSING ISTHEMIC HEALTH DISEASE

Sumaira Kanwal*, Muhammad Aslam** and Khalil-ur-Rahman***
*Department of Math and Stat, University of Agriculture, Faisalabad
**DHQ Hospital, Faisalabad
***Department of Chemistry and Biochemistry, University of Agriculture, Faisalabad

Faisalabad is third most populous and industrial city, known as Manchester of Pakistan. Most of the people working in the industries of this city are exposed to highly polluted and toxic environment. Lead is a natural metal found in the environment and its contamination exceeds the range of normal limits by human activities causing a lot of health hazardous. An effort is made to assess the association of anemia and cholesterol with the development of IHD among industrial workers who are exposed to the lead polluted environment. For this purpose the study was conducted during a period of one year (2006-7) and the respondents were the patients from industrial area coming to the hospitals visiting at DHQ Hospital Faisalabad.

Only those patients were selected for this study who were diagnosed with clinical symptoms of lead toxicity. The demographic features of the respondents regarding their age, gender, marital status, family size, education, income, duration on job, working place and nature of work were considered. The data of this study was categorical nature and this measures the associations among exposure to the environment with lead toxicity and causative risk factors i.e., cholesterol level, Hb level (anemia) causing ischemic heart disease (IHD) were studied.

Keywords: Industrial workers; lead toxicity, environmental pollution; clinical symptoms; IHD, renal problems, anemia

INTRODUCTION

Faisalabad is an important industrial city of Pakistan. The environment of this city is highly polluted due to industrial effluents. Lead is one of the most crucial environmental pollutants and it is the number one environmental pollutant all over the world causing health hazards (Lockitch, 1991; Olaiz, *et al.,* 1996). The people exposed to lead toxicity are at high risk of health problems like Ischemic Heart Disease (IHD), renal problem and anemia and may even cause deaths in some cases (Moor and Moor, 1994).

The major source of lead is from occupations where lead and lead based components are used, resulting in high prevalence of lead toxicity in the population exposed to such activities (Fanning, 1988). Most of the environmental exposure occurs through inhaling air containing lead dust, drinking water supplied through leaded pipe lines and consuming processed, preserved and stored food (Adgate, *et al.,* 1995; Poccok, 1980). Occupational exposure to workers is seen in lead based industries such as lead acid battery manufacturing, cable and wire products industries, rubber and plastic industries, soldering activities, in-foundry work such as casting, forging and grinding activities. Apart from this, construction workers involved in painting or paint removal, plumbing, welding and cutting also get exposed to lead (Awad el Karim, *et al.,* 1986; Gittleman, *et al.,* 1994).

Lead exposure is also seen due to the usage of certain traditional medicines and folk remedial procedures (Peter and Alan, 2000). Exposure to lead (Pb) is one of the foremost public health concerns today. Lead is a cumulative toxin that is absorbed by the gastrointestinal tract. Once absorbed, lead is transported to all organs and tissues. In industry workers the most important exposure route is inhalation. Lead may be in the air if dust is created by grinding or similar procedures, or if fumes are created by welding torches. This airborne material is easily breathed in by any workers in the vicinity. Workers consumed significant amounts of lead through ingestion via contact of dusty unwashed hands with food and even cigarettes. Certain lead compounds will be absorbed through the skin. The organs most affected by repeated exposure to lead or lead salts are the gastrointestinal, hematopoetic and nervous and neuromuscular systems. Chronic exposure to lead has been considered to cause behavioral problems, impaired motor skills and IQ deficit (Schwartz, 1994).

The most frequent signs of lead poisoning are muscle weakness, lassitude, insomnia, weight loss, anemia, headaches, and loss of memory, irritability, colic and paralysis of the extensor muscles of the wrist (Williams and Burson, 1985). There are three possible routes of lead exposure i.e., inhalation, ingestion and absorption. Renner (1995) gives figures for adult retention of 10-15% and for retention in children of 40-50% of lead ingested. Absorption of the lead ingested is a function

of the physical and chemical characteristics of Pb and the physiology of the individual. In adults, exposure to lead affects primarily the peripheral nervous system and can cause impairment of hearing, vision, and muscle coordination. Lead also damages the blood, kidneys, heart and reproductive system.

Inorganic lead can cause harmful effects to certain types of blood cells, including reduced hemoglobin production and reduced life span and function of red blood cells. Reduced hemoglobin production has been associated with low-level exposure to inorganic lead in the workplace. With moderate exposures, anemia has been observed in lead-exposed workers. Low, moderate or high exposures to inorganic lead compounds may increase blood pressure, particularly in men. Electrocardiographic (ECG) abnormalities were observed in workers with moderate exposure to inorganic lead compounds. Increased prevalence of IHD in polluted areas of developing countries has shown its relation with industrialization and automobile operations, which are source of toxic elements like Pb. These toxic compounds are inhaled and consumed as a result of fall out from the vehicle exhausts on nearby fruit crops (Donald, 1986). Several metal ions including Pb are known to raise blood pressure.

The study was planned to find out prevalence of IHD, cholesterol and anemia in the context of lead polluted environment. The information obtained from the respondents with clinical findings was the bases for this study. These findings were useful in planning the safety measures in the people working in the lead environmental pollution.

MATERIALS AND METHODS

The aim of the study was to find out the prevalence of IHD, in the respondents working in lead polluted environment. The parameters used for this study were the presentation of clinical symptoms i.e., cramping, colicky abdominal pain, constipation, nausea, vomiting, encephalopathy, headache, confusion, stupor, seizure, fatigue, gastrointestinal problems, arthragia, myalgia, insomnia and impaired concentration (Williams and Burson, 1985) and clinical findings (the level of cholesterol and anemia) of the respondents. The study was conducted during 2005-06 on 350 patients of the medical OPD at DHQ Hospital Faisalabad. The respondents were categorized according to the exposure towards clean environment and polluted environment. The demographic features of the patients regarding age, gender, marital status, family size, working place, nature of job, duration of job and economic status of the respondent were recorded with the clinical findings of lead level, serum cholesterol, hemoglobin level, ECG and blood pressure level.

The data was tabulated and analyzed by using the SPSS (Statistical package for social sciences) to find out the associations among lead levels and other variables.

RESULTS AND DISCUSSION

The age of 58.3 % respondents was between 31-50 years and 81.7 % respondents of this study were male. Majority of the respondents (78.9%) were married and 61.4 % respondents were having a family size of 5-10 persons. Regarding the qualification of the respondents majority of them (53.1 %) were having up to primary level education where as only 6.3 % respondents were graduate.

In this study 65.7 % respondents were exposed to polluted environment whereas 34.3 % had chance to work in clean atmosphere. Majority of the respondents (81.1 %) had poor living status (having income <10,000 rupees per month) whereas only 6 % were having income of more than 20,000 rupees per month. The respondents were distributed according to their nature of job as teacher 9.4 %, clerk 10.9 %, landlord 5.1 %, businessman 7.7 %, transport workers 20.3 %, petrol pump workers 9.7 %, workshop workers 14.0 %, industry workers 12.0 % and house wives 10.9 %.The majority of the respondents 65.7 %, have working duration in the same job for more than 5 years whereas 12.3 % had been on work for less than 2 years.

Clinical Findings

The toxic level of lead (>1.2 ppm) was determined in 42.0 % respondents of this study, permissible level (0.4-1.2 ppm) was present in 32.0 % and normal level (<0.4 ppm) was found in only 26.0 %. The severe anemia (Hb < 7 g/dl) was found in 42.0 % and 39.1% respondents had moderate anemia (Hb 7-10 g/dl) whereas 18.9 % respondents were having normal level of Hb. There were 56.0 % respondents who had normal level (150-220 mg/dl) of cholesterol while 44.0 % had toxic level (>220 mg/dl).

Analysis

The results in Table 1 indicated that 28.0% respondents exposed to non-polluted and 72.0% were exposed to polluted environment. A higher percentage of respondents were having blood lead level at normal (42.9 %) and permissible range (50.0 %) whereas a low percentage of respondents (7.1 %) had toxic blood lead level who were exposed in non-polluted

Table 1. Environmental Exposure *Blood Lead Level

Exposure	Blood Lead Level (µg/dL)			Respondents %
	Normal (Less than 10 µg/dL)	Permissible (10-20 µg/dL)	Toxic (Above 20 µg/dL)	
Non-Polluted	42 42.9%	49 50.0%	77 1%	98 28.0%
Polluted	49 19.4%	63 25.0%	140 55.6%	252 72.0%
Total	91 26.0%	112 32.0%	147 42.0%	350 100.0%

Chi-Square = 68.033*. P-value = 0.000

environment. The results also revealed that the respondents exposed to polluted environment had a higher toxic blood lead levels in majority of the respondents (55.6 %). It clearly indicates that exposure in polluted environment increases the risk of lead toxicity which shows a statistical association between environmental pollution and lead toxicity level in the respondents (p=0.00).

The results in Table-2 indicated that the respondents who had normal blood lead levels were 26.0 %, with permissible level of lead 32.0 % whereas 42.0% respondents were having level of lead at toxic range. The analyzed data in Table-3 revealed that there were a few number of respondents (15.4 %) had higher cholesterol level in those who were having normal range of blood lead levels. There were higher percentage of respondents (37.5 %) had high cholesterol level in those who were having permissible range of blood lead levels whereas 66.7 % of the respondents had high cholesterol level in the respondents having toxic range of blood lead levels. It shows that toxic level of lead has direct association with high cholesterol level (a causative factor in IHD) in the respondents.

Table 2. Blood Lead Levels *Hemoglobin

Blood Lead Levels	Hemoglobin			Respondents %
	Less than 7 g/dL	7-10 g/dL	Above 10 g/dL	
Normal (Less than 10 µg/dL)	7 7.7%	52 57.1%	32 35.2%	91 26.0%
Permissible (10-20 µg/dL)	25 22.3%	60 53.6%	27 24.1%	112 32.0%
Toxic (Above 20 µg/dL)	126 85.7%	14 9.5%	7 4.8%	147 42.0%
Total	158 45.1%	126 36.0%	66 18.9%	350 100.0%

Chi-Square = 174.282*, P-value = 0.000

There was a few percentage of respondents (7.7 %) suffering from severe anemia who were having normal range of blood lead level. The respondents within permissible range of blood lead levels had higher percentage (22.3 %) of respondents whereas the respondents with toxic lead level had majority of them (85.7 %) suffering from severe anemia. It shows direct association of toxicity level of lead with hemoglobin level (anemia) determined in the respondents.

The results of Table-4 (a) indicated that there were 196 respondents who had cholesterol level in the range of 150-220 mg/dL and out of those, 56 respondents had their hemoglobin level less than 7 g/dL (severely anemic) and 37.5 % of them were suffering from IHD. The 84 respondents had hemoglobin level up to 7-10 g/dL (moderate anemia) and out of those 28.6 % were suffering from IHD whereas 56 respondents who had their hemoglobin level above10 g/dL and out of them only 16.1 % had been suffering from IHD.

Table 3. Blood Lead Levels *Cholesterol Level

Blood Lead Levels	Cholesterol Level		Respondents %
	150-220 g/dL	Above 220 g/dL	
Normal (Less than 10 µg/dL)	77 84.6%	14 15.4%	91 26.0%
Permissible (10-20 µg/dL)	70 62.5%	42 37.5%	112 32.0%
Toxic (Above 20 µg/dL)	49 33.3%	98 66.7%	147 42.0%
Total	196 56.0%	154 44.0%	350 100.0%

Chi-Square = 62.813*, P-value = 0.000

Table 4. Cholesterol *Hemoglobin *IHD

Cholesterol Level (g/dL)	Hemoglobin	IHD		Respondents %
		IHD	Non-IHD	
(a) 150-220	Less than 7 g/dL	21 37.5%	35 62.5%	56 28.6%
	7-10 g/dL	24 28.6%	60 71.4%	84 42.8%
	Above 10 g/dL	9 16.1%	47 83.9%	56 28.6%
	Total	54 27.6%	142 72.4%	196 100.0%
(b) Above 220	Less than 7 g/dL	40 44.0%	51 56.0%	91 59.1%
	7-10 g/dL	13 26.5%	36 73.5%	49 31.8%
	Above 10 g/dL	1 7.1%	13 92.9%	14 9.1%
	Total	54 35.1%	100 64.9%	154 100.0%

a; Chi-Square = 6.518, P-value = .038 , b; Chi-Square = 9.520, P-value = .009

The results of Table 4(b) revealed 154 respondents having their cholesterol level above 220 g/dL and out of those, 91 respondents had their hemoglobin level less than 7 g/dL (severely anemic) and 44.0 % of them were suffering from IHD. The 49 respondents had hemoglobin level up to 7-10 g/dL (moderate anemia) and out of those 26.5 % were suffering from IHD whereas 14 respondents who had their hemoglobin level above 10 g/dL and out of them only 7.1 % had been suffering from IHD. It indicates that anemia is major contributing factor of IHD which itself is directly affected by high cholesterol level. The significant association exists among IHD and its contributing factors.

CONCLUSION

The results of this study revealed that respondents working in polluted environment are suffering from high blood lead level. These high levels of lead present in the blood of workers have a direct causing effect on Hb and cholesterol level which are contributing factors of IHD. There are intensive needs to provide proper awareness and facilities for the persons exposed to the lead environmental toxicity to prevent them from the health risk factors and Ischemic Heart Disease.

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