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SHORT COMMUNICATION

Blood Lead Level (BLL) in the Adult Population of Jodhpur: A Pilot Study

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Abstract Lead interferes with a variety of body processes and is toxic to many organs and tissues including the heart, bones, intestines, kidneys, and reproductive and nervous systems. Routes of exposure to lead include contaminated air, water, soil, food, and consumer products. The possibility of lead exposure in humans is therefore of great significance from health point of view. Occupational exposure is a common known cause of lead poisoning in adults but current status of adults exposed otherwise is not known. School teachers representing wide local population were selected and asked to furnish information regarding possible lead exposure. Blood lead level (BLL) was estimated using anodic stripping voltammetry. The mean BLL was 6.89 ± 9.5 μg/dl (<3.5–>65 μg/dl) in representative adult population. Out of the total 16 % were found to be having BLL >10 μg/dl which has significantly decreased from leaded gasoline era. Those with increased BLL (>10 μg/dl) were found to have common determinants like usage of old metallic pipes for plumbing, water consumption without any purification system, usage of cosmetics and Ayurvedic/herbal medicines.

Keywords Blood lead · Blood lead level · Lead exposure

Introduction

Lead exposure is inadvertent because of it's wide use in various spheres of day to day life. Lead has been of help to mankind because of it's versatile physical and chemical properties. Lead is a common industrial contaminant because of the wide scope and long-standing pursuit of industrial activities with lead over millennia. The environmentally persistent nature of lead makes any attempt at remediation expensive and difficult. The impact on human health has lead to 143,000 deaths every year and 0.6 % of the global burden of disease [1]. About one half of the burden of disease from lead occurs in the WHO South-East Asia Region [2]. Greater blood lead levels (BLL) are associated with higher all-cause mortality in both men as well as women as supported by evidence furnished by recent prospective cohort studies conducted in general population and deaths from cardiovascular diseases are largely responsible for the associations. This association is apparent in the range of BLLs below 10 μg/dl [3]. Although CDC has designated 10 μg/dl as the reference BLL for adults; levels ≥10 μg/dl are considered elevated [4]. This also seems to be considerably high as epidemiologic studies of mortality in adults indicate that BLLs at >2 μg/dl were significantly associated with increases in both all cause and cardiovascular mortality [5].

Leaded petrol was one of the major suggested cause of lead in the environment. Study undertaken by George foundation in six major cities of India reported that 40.2 % of adults and 51.4 % of children had BLL >10 μg/dl [6]. This eventually lead to discontinuation of leaded gasoline in India. US adults NHANES Surveys of 1988–1994 and 1999–2002 indicated that percentage of those with BLL >5 μg/dl fell from 20.5 to 5 % [7]. The Indian data conveys different story altogether. BLL estimated in post leaded

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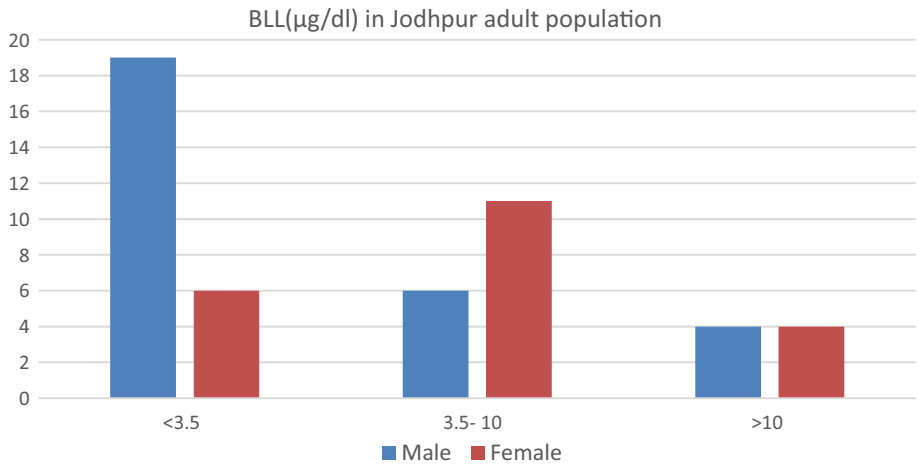

Fig. 1 Blood lead level in Males and Females of Jodhpur population

gasoline era was significantly high in traffic police personal [8] as well as local population [9, 10]. NIOH Community based studies in Bhilwara (Rajasthan) 2005–2006 reported BLL to be between 1.4–14 µg/dl and in Kayar village (Rajasthan) reported BLL between 2.1–18 µg/dl [11]. The current status of local population is not available. We selected school teachers to find out the same as they represent a wide local population and they are the best means to convey the message to the society about lead associated hazards.

Materials and Methods

The study group comprised of healthy school teachers (49) from various public and government sectors representing various nodal areas of Jodhpur. The informed consent was taken. The teachers were given a questionnaire which included questions regarding their medical history, usage of over the counter or any other medications with special reference to Ayurvedic/herbal medicines, food habits, hobbies, usage of cosmetics, potable water purification, house location from traffic congestion, plumbing and paint in the house etc. Their vitals including blood pressure were noted down. The demographic details and responses were recorded. Venous blood samples in EDTA vials were collected and BLL was estimated by FDA approved Lead Care 11 analyser in the department of Biochemistry, AIIMS, Jodhpur after ensuring proper quality control.

Result and Discussion

The mean BLL was 6.89 ± 9.5 µg/dl ranging from less than 3.5 to greater than 65 µg/dl in 49 teachers [M = 29, F = 20]. In male subjects 7.64 ± 3.1 µg/dl whereas in female subjects it was found to be 6.18 ± 3.7 µg/dl. Almost similar BLL was observed in rural population (BLL: 8.9 ± 7.2 µg/dl) in our previous study [9].

51 % of the subjects had BLL <3.5 µg/dl and 33 % had BLL ranging between 3.5–10 µg/dl. Out of the total 16 % were found to have BLL >10 µg/dl which is considered to be high according to CDC current guidelines [4]. Although BLL has dropped significantly from earlier 40.2 % [6] times, significant percentage of population is still at risk of lead related adverse health effects.

In the subset of subjects with BLL <10 µg/dl, 42.9 % were found to have systolic hypertension (>140 mmHg) and 30.6 % had diastolic hypertension (>90 mmHg). Low level chronic lead exposure is associated with cardiovascular diseases including hypertension. Many have reported a positive relationship between BLL and blood pressure [12]. Others have also noted the change in systolic pressure of 1.0 mmHg (95 % CI 0.5–1.4) and diastolic pressure of 0.6 mmHg (95 % CI 0.4–0.8) with a doubling in BLL [13].

Drinking water can be source of environmental lead exposure. 55 % of the study group was using metallic pipes for plumbing. Out of this 30 % had BLL falling in the range 3.5–10 µg/dl and 11 % had BLL >10 µg/dl.

19 % with BLL 3.5–10 µg/dl and 16 % with BLL >10 µg/dl were consuming water without any purification system. Leaching of lead into drinking water occurs from outdated fixtures and solders containing lead and resulted in a 9.6-fold increase in the incidence of elevated BLLs [14]. Local water body of Jodhpur, Kailana lake is known to contain high amounts of lead [15] (Fig. 1).

Cosmetics are also potential source of lead exposure [16]. 16 % of the group (BLL >10 µg/dl) was using cosmetics including hair dye and Ayurvedic medication which is a potential cause of lead toxicity [17].

Those with increased BLL (>10 µg/dl) were found to have common determinants like usage of old metallic pipes for plumbing, water consumption without any purification

system, usage of cosmetics and Ayurvedic/herbal medicines.

Hence it can be said that general population which is not exposed to lead occupationally is still lead exposed despite discontinuation of leaded petrol. Although BLLs are gradually falling in the general population still further measures need to be adopted to limit use of lead in our day today life.

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