BLOOD LEAD LEVEL AMONG CHILDREN IN BASRAH

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ABSTRACT

A cross sectional study to assess Blood Lead Levels (BLLs) among children in Basrah was carried out during July 2005. The study included children 1-6 years old attending three selected primary health care centres located at different socioeconomic areas in Basrah *(representing both rural and urban communities)*. Two of the health centres are located in the city centre, one in a relatively high socioeconomic area (Al-Razi health centre) & the second in low socioeconomic area (Al-Seef health centre). The third health centre included in the study is located in Abul-Khasib district. The questionnaire method was used in collecting information regarding socioeconomic factors that may be related to environmental exposure to lead, and a blood sample was taken from each child to measure the blood lead level. The BLLs among children in this study ranged between 1 and 65 µg/dL (mean ± SD, 11.59 ± 9.1 µg/dL). Overall, 40.4% of children had elevated blood lead levels ≥10 mg/dL). The mean BLL was significantly higher for children who live in rural or in urban low socioeconomic area than that for children living in urban high socioeconomic area. Age above 2 years was significantly associated with elevated BLLs.

INTRODUCTION

Lead poisoning in children has recently become a very topical issue. Largely due to the realization that blood lead levels previously thought safe, could result in adverse long-term effects[1]. Lead poisoning can have serious and even fatal consequences at any age, but young children are especially vulnerable. Lead is an environmental toxicant that may deleteriously affect the nervous, haematopoietic, endocrine, renal, and reproductive systems[2]. Lead exposure in young children is particularly serious because children absorb lead more readily than do adults and because the developing nervous system of children is more susceptible to the effect of lead. Blood lead levels (BLLs) as low as 10 µg/dL can adversely affect the behaviour and development of children. Permanent effects on physical, behavioural and cognitive development may result[3,4]. Environmental lead exposure occurs from burning of fossil fuels, mining, and manufacturing and from drinking water where lead pipes are used. Exposure at home may occur through ingestion of old leaded paint, and pigments and glazes used in pottery. Some health care products and folk remedies are also known to contain lead. The adverse health effects of lead pollution are known to be more pronounced in vulnerable populations such as children and members of socioeconomically disadvantaged communities[5]. After measures to control lead pollution were implemented in the United States, beginning in 1970, blood lead levels (BLLs) in children have declined by >80%. Conversely, lead pollution remains a public health concern in developing countries[6]. The aim of this study is to provide information on BLLs in children ≤ 6 years of age from three different locations in Basrah.

METHODOLOGY

A cross sectional study involving children attending primary health care centers in Basrah was carried out during July 2005. The study included children 1-6 years old attending three selected primary health care centres located at different socioeconomic areas in Basrah *(representing both rural and urban communities)*. Two of the health centres are located in the city centre, one in a relatively high socioeconomic area *(Al-Razi health centre)* & the second in low socioeconomic area *(Al-Seef health centre)*. The third health centre included in the study is located in Abul-Khasib district, 30 Kms to the south of Basrah city. In each primary health care centre, all eligible children *(1-6 years old)* attending on two selected days were enrolled in the study *(n = 421)*. All primary health care centres were visited during the National Immunization Days. The purpose of the study was explained to parents and their verbal consent to participate in the study was obtained, none refused to participate. The research protocol was approved by the scientific committee of Environmental Health Educational Resource Center, Basrah Medical College. A special questionnaire form was filled for each child. The questionnaire included information regarding socioeconomic

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factors that may be related to environmental exposure to lead like parental education and occupation. Then two to three drops of blood were obtained from each child through finger prick after thorough washing of the hand by soap and water. The blood was immediately mixed with a treatment reagent and then transferred to a sensor by a pipette. The sensor was then introduced into a Lead Care analyzer (Lead Care Inc., Chelmsford, MA, USA), which displayed the results.

Chi-squared test was carried out to determine the association between BLLs and other variables including: age, father's education, pica behaviours, and presence of generator in the house. One way analysis of variance (ANOVA) was used to assess the effect of place of residence on BLLS among children. Statistical analyses were conducted using SPSS for Windows (version 11).

RESULTS

A total of 421 children were included in the study, 211(50.1%) were males &210 (49.9%) were females. Overall, 170(40.4) had elevated blood lead level, defined as ≥10 µg/dL. The prevalence of elevated blood lead level among males was 41.7% which is nearly similar to that for females (39%). The BLLs among children in this study ranged from 1 to 65 µg/dL (mean ± SD, 11.59±9.1µg/dL). The distribution of blood lead levels of the study population is shown in (Table-1).

Table 1. ***Distribution of BLLs among children in Basrah city.***

	Frequency	Percent
<10	251	59.6
10-19	125	29.7
20-44	35	8.3
45-70	10	2.4
Total	421	100.0

Associations between high risk status (elevated blood lead level) and selected characteristics (father's occupation, pica behaviours, presence of generator in the house, and use of alkuhel as cosmetic) were evaluated. The comparisons were made between children with high blood lead level (≥10 µg/dl) and those with low level (<10 µg/dl) (Table-2). Children with elevated blood lead level did not differ significantly from those with low lead level with respect to their father's occupation, pica behaviours, presence of a generator in the house, and the use of Alkuhel as cosmetic. Only age of children was found to be significantly related to high blood lead level.

Table 2. ***Relationship between selected characteristics and elevated blood lead level among children aged one to six years: Basrah, Iraq, 2005.***

Characteristic	No. in sample	% Elevated BLLS (≥10 µg/dL)	Odds Ratio	(95% Confidence Interval)
Total	421	40.4		
Age*(year)				
1-2	346	37	Reference	(1.3 - 3.6)
3-6	75	56	2.16	
Father occupation†				
Risky	121	54.5	Reference	(0.29 - 0.8)
Not risky	300	34.7	0.44	
Pica behavior†				
Yes	142	48.6	Reference	(0.39 - 0.90)
No	279	36.2	0.6	
Presence of generator†				
Yes	279	42.7	Reference	(0.49 - 1.43)
No	142	35.9	0.75	
Alkuhel as cosmetic†				
Yes	225	41.3	Reference	(0.62 - 1.35)
No	196	39.3	0.91	

*P <0.05, †P >0.05

Of the 421 studied children, 136(32.3%) were residents in an urban area of high socio-economic level, 190(45.1%) were residents in an urban area of low socio-economic level, and the remaining 95(22.6%) were residents in a rural area. The study found that 49(36.1%), 87(45.8%), and 34(35.8%) of children residents in these areas respectively had a capillary blood

lead level ≥10 µg/dl. The mean BLL and its 95% confidence interval for children residents in the three areas are shown in (Table-3). According to the ANOVA test, the differences between the three groups were significant (P<0.05).

Table 3. ***Blood lead levels among children according to place of residence.***

Area of residence	Number	Mean	Std. Deviation	95% Confidence Interval of the Mean	
				Lower Bound	Upper Bound
Urban high social area	136	9.65	6.51	8.55	10.76
Urban low social area	190	12.71	10.82	11.16	14.26
Rural area	95	12.09	12.31	9.59	14.60
Total	421	11.58	10.10	10.62	12.55

DISCUSSION

Lead poisoning is an environmental disease that is the result of human activities. This study indicated that 40.4% of our children 1 to 6 years of age had elevated BLLs (≥10 µg/dL). This result is a greater estimate than that found in USA in which only 6.3% of children reported to have high BLLs[6]. Conversely, a previous study based on data from a developing country have estimated that more than half of the children in India had BLLs ≥10 µg/dL[7]. The high proportion of children with high BLLs in our study may be due to their high level of exposure to lead from a variety of sources. However, environmental pollution like leaded gasoline and benzene which was still being used at the time of data collection is likely to be a major contributor. Furthermore, it has been suggested that falsely elevated results may be caused by contamination of the tube or the collection equipment or by poor laboratory methodology. In addition, capillary blood samples are more likely to be inaccurate than larger volume venous samples[8]. Finally, lead does not remain in blood for long period relative to its turnover in bone. Thus, a BLL is a 'snapshot' of a narrow window in time. Low BLLs do not exclude the possibility of substantial bone lead stores. Conversely, high BLLs do not necessarily signify a large body burden[8]. In our study, age above 2 years was significantly associated with elevated BLLs. A similar relationship of age with BLL has also been reported in population surveys conducted in the United States and India[7,9]. A likely explanation for our results of increasing lead levels with age is that children get more mobile as they grow older. This exposes them to lead from various sources such as paint, soil, and food[10]. One striking characteristic in this study is that it distinguishes children at risk for having an elevated blood lead level in city center. Significantly higher BLLs were found among children who live in a low socio-economic area than those who live in a high socio-economic area. Similarly, children living in the low socio-economic rural area had elevated BLLs. Numerous studies have demonstrated that impoverished, inner-city children are at increased risk for having elevated blood lead levels. In fact, during the 1960s, lead poisoning was considered ***"a disease of the slums"[10,11].*** Since then, however, it has become obvious that sub-clinical lead toxicity and lead poisoning are environmental diseases, resulting primarily from exposure to lead-based paint and lead-contaminated dust and soil in and around older housing that is in disrepair or has undergone renovation[11]. Thus, children from poor social areas who lived either inside or outside the city were more likely to be recognized as having elevated blood lead levels.

In conclusion, according to the results of the present study a relatively high proportion of children in Basrah had elevated BLLs. Since a blood lead level as low as 10µg/dL is associated with decreased intelligence and impaired neurobehavioral development. Screening of all children at an early age as possible is very important because early identification of the problem may help in prevention of detrimental developmental defects.

REFERENCES

1. Breen J, Stroup C. Lead poisoning. 1st ed. Lewis publishers, 1995.
2. Hall J, Plouzek KH, Christensen D. 1998 Nebraska Surveillance Data Report on lead poisoning among children less than six years. Nebraska epidemiology. [Internet]
3. Lidsky TI, Schneider JS. Lead neurotoxicity in children: basic mechanisms and clinical correlates. Brain 2003; 126:5-19.
4. Brody DJ, Pirkle JL, Kramer RA, et al. Blood lead levels in the U.S. population: Phase I of the Third National Health and Nutrition Examination Survey (NHANES III, 1988 to 1991). JAMA 1994; 83:272-277.
5. Agency for Toxic Substances and Disease Registry. The nature and extent of lead poisoning in children in the United States: a report to Congress. Atlanta, GA: Agency for Toxic Substances and Disease Registry, 1988.
6. Kaufmann RB, Clouse TL, Olson DR, et al . Elevated Blood Lead Levels and Blood Lead Screening Among US Children Aged One to Five Years. Pediatrics 2000; 106 (6): 79.
7. Jain NB, Hu H. Childhood Correlates of Blood Lead Levels in Mumbai and Delhi. Environmental Health Perspectives 2006; 114 (3).
8. Oberle MW.Lead poisoning: a preventable childhood disease of the slums. Science 1969; 165:991-992.
9. Hunt TJ, Hepner R, Seaton KW. Childhood lead poisoning and inadequate child care. Am J Dis Child 1982; 136:538-542.
10. Lanphear BP, Weitzman M, Eberly S. Racial differences in environmental exposures to lead. Am J Public Health 1996; 86:1416-1421.
11. Needleman HL, Schell A, Bellinger D. The long-term effects of exposure to low doses of lead in childhood: an 11-year follow-up report. N Engl J Med 1990; 322(2):83-8.