

# Blood Lead Levels in Young Children in Chakshahzad, Islamabad

Pages with reference to book, From 215 To 218

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## Abstract

Blood lead levels were estimated in one hundred and seventy school children, aged 13 to 19 years, residing in Chakshahzad area of Islamabad. The overall mean blood lead level was 2.38 ug/dl (range 0.2 to 8.6 ug/dl), 3.22 ug/dl in boys and 1.49 ug/dl in girls. A significant difference ( $p < 0.01$ ) was found in mean blood lead concentrations between the two sexes. The highest mean levels for lead were found at the age of 13 years. Blood lead levels in adolescents reported here were relatively low. They reflect very little or no risk to the health of children in Chakshahzad and it also indicated that area of Chakshahzad is relatively free from any lead pollution (JPMA 45:215,1995).

## Introduction

Environmental lead pollution is widely regarded as a risk to child health. Children are more vulnerable to lead poisoning, because of their developing central nervous system, smaller body size, higher rate of absorption and tendency to put objects in their mouth<sup>1-4</sup>. Raised blood lead concentrations in children, can be due to exposure to lead in the air, soil, household dust, food and water supplies, lead paints, pica and oriental cosmetics and finger sucking<sup>5-11</sup>. Lead inspired as small particulate matter and ingested in food and water is absorbed through lungs and gastrointestinal tract<sup>12</sup>. It tends to concentrate near the ground and is taken up more by children than adults because of their shorter stature. Acute lead toxicity in children may give rise irreversibly to increased cerebrospinal pressure, convulsions, memory loss, acute encephalopathy and death<sup>10,13,14</sup>. High blood lead levels also disturb the growth patterns of children<sup>15</sup>. Lead is purely toxic element as it is not involved in any of the physiological functions of the organism. The normal lead levels in any body fluid should be zero although it has become customary to accept the normal blood levels observed in industrialized society as "normal"<sup>16</sup>. The present study was undertaken to estimate blood lead levels in apparently healthy young school children and to assess factors that might be expected to influence blood lead concentrations for example, age, sex, location of home and social background.

## Material and Methods

One hundred and seventy schoolchildren (age group 13 to 19 years) from the four Federal Government Schools located in the suburbs of Islamabad city were included. All children were apparently healthy and free from any infection and were not on any medication, particularly, steroids. Age, sex, family income area of residence and previous history of any serious illness were recorded. Blood samples were taken by disposable plastic syringes with steel needles. Samples were immediately transferred to acid washed eppendorf tubes containing 200 ul of 10% EDTA. The EDTA solutions had been previously tested for the absence of lead. Sample preparation was done by the method of Subramanian and Jean<sup>17</sup>. Blood lead concentrations were estimated in duplicate by atomic absorption spectrometry. All labware was cleaned by 24 hours soaking in 20% nitric acid and rinsing in deionized water. A

Shimadizu Model 670 atomic absorption spectrophotometer equipped with 670 G, a graphite furnace, a deutenm arc background corrector, PR-4 printer, hollow cathode lamp (Hainamatus Photonics K. K., Japan) was used for analysis. Nitrogen was used as inert gas to provide inert environment. The entire analytical operation was performed in a complete sterile environment to avoid any contamination.

## Results

One hundred and seventy children (88 boys, 82 girls) were studied. Their ages ranged from 13 to 19 years. Majority belonged to low income families. All were residing in more than 20 villages located near the schools in Chakshahzad area, Islamabad. Clinical evaluation did not reveal any evidence suggestive of lead toxicity or histoiy of pica in any child. The frequency distribution of blood lead concentrations is shown in Figure.

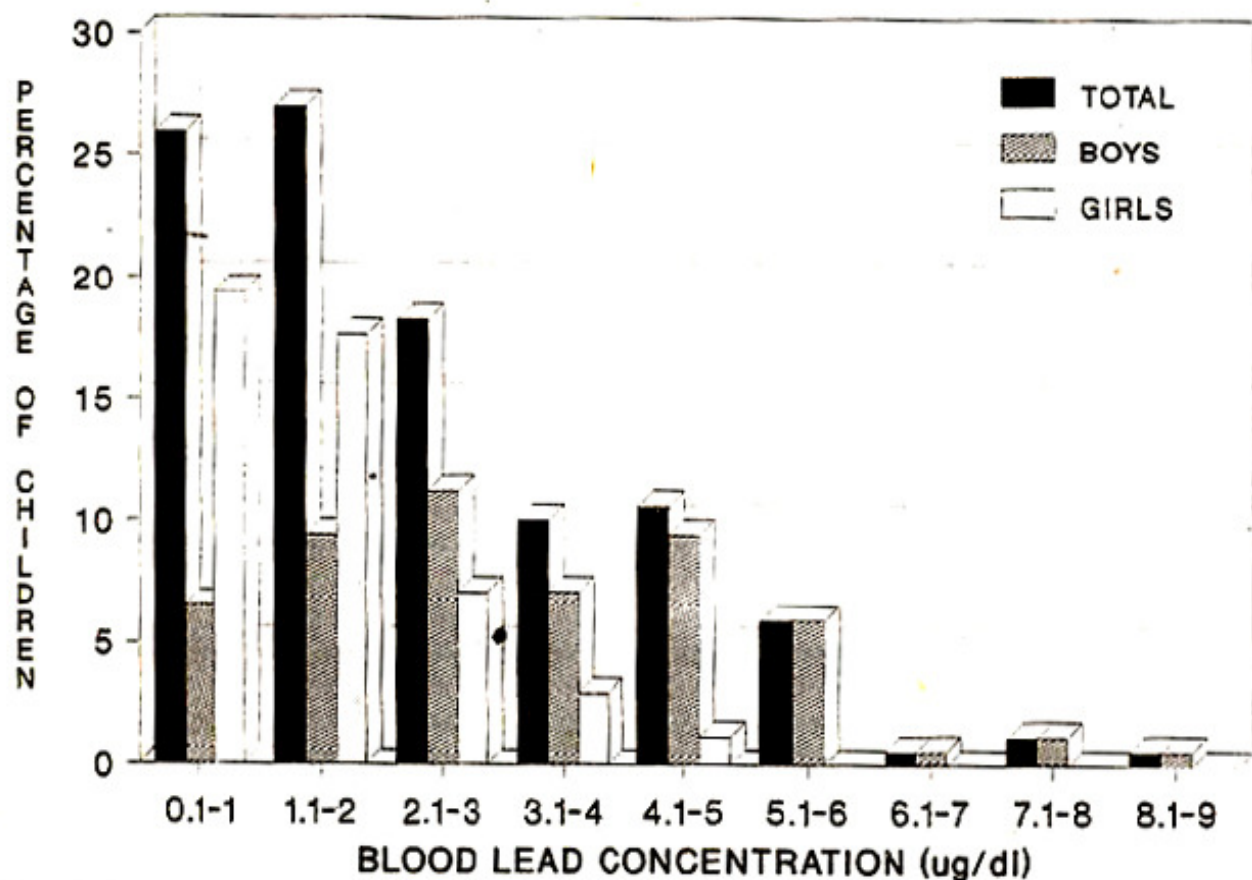


Figure. Distribution of blood lead levels (ug/dl) in total (170) children.

Ninety (53%. 27 boys and 63 girls) had levels between 0.2 to 2.0 ug/di. Majority (91%) of girls had blood lead levels between 0.2 to 3.0 ug/dl. In remaining 9%, the levels ranged between 3.1 to 4.8 ug/dl. Whereas in boys, 30% had levels between 0.2 to 2.0 ug/dl, 35% between 2.1 to 4.0 ug/dl and 29% between 4.1 to 6.0 ug/dl, only 4% boys had levels between 6.1 to 8.6 ug/dl. The maximum level of lead in girls (4.8 ug/dl) was lower than in boys (8.6 ug/dl). The mean blood lead levels (ug/di) in children is shown in table I.

Table I. Mean ( $\pm$ SE) Blood lead levels (ug/dl) in children.

Children	No	Blood lead levels ug/dl		
		Mean	SE	Range
Boys	88	3.22*	0.19	0.2-8.60
Girls	82	1.49	0.10	0.2-4.68
Total	170	2.38	0.13	0.2-8.60

\* $p < 0.01$

The mean lead levels in girls were significantly ( $p < 0.01$ ) lower than in boys. Distribution of mean blood lead levels (ug/dl) according to age is shown in table II

**Table II. Mean ( $\pm$ SE) blood lead levels (ug/dl) according to age in boys, girls and total children.**

Age (Years)	Boys Mean $\pm$ SE (No)	Girls Mean $\pm$ SE (No)	Total Children Mean $\pm$ SE (No)
13	4.23 $\pm$ 0.52 (16)	1.20 $\pm$ 0.19 (10)	2.74 $\pm$ 0.02 (26)
14	3.22 $\pm$ 0.44 (17)	2.10 $\pm$ 0.27 (16)	2.69 $\pm$ 0.21 (33)
15	2.98 $\pm$ 0.43 (16)	1.55 $\pm$ 0.18 (18)	2.30 $\pm$ 0.17 (34)
16	2.17 $\pm$ 0.39 (9)	1.08 $\pm$ 0.20 (9)	1.66 $\pm$ 0.02 (18)
17	3.64 $\pm$ 0.48 (13)	1.13 $\pm$ 0.23 (12)	2.42 $\pm$ 0.21 (25)
18	2.82 $\pm$ 0.65 (9)	1.24 $\pm$ 0.41 (10)	2.06 $\pm$ 0.41 (19)
19	2.62 $\pm$ 0.62 (8)	1.85 $\pm$ 0.47 (7)	2.27 $\pm$ 0.32 (15)

Highest levels were found at the age of 13 years in the whole group.

## Discussion

Children are more sensitive to lead than adults<sup>7,8,14-14</sup>. Their exposure is also greater because of crawling, finger sucking, mounding and pica<sup>3,8,13,16,18</sup>. Lead exposure in early childhood may therefore, result in delayed neuropsychological development<sup>19</sup>. Lead based paint and dust containing high levels of lead remain a health menace in an estimated 3.8 million U.S. homes housing children seven years of age or younger<sup>8,20</sup>. Several million children in Europe risk serious poisoning from lead based paint in old buildings<sup>21</sup>.

In recognition of data indicating that exposure to lead may have adverse effects at blood lead concentrations well below 25 ug/dl (1.2 u mol/L), current guidelines in the United States have identified a blood lead concentration of 10 ug/dl (0.5 umol/L) as the level of concern for early toxic effects in children<sup>22</sup>. The Department of Environment in Britain allows higher blood lead concentrations than do the regulations in either France or the U.S. The upper limit is 25 ug/dl in Britain and only 10 ug/dl in France<sup>21</sup>. A survey from Birmingham reported<sup>11</sup> mean blood lead concentrations

0.47 umol/L (1 ug/dl=0.048 umol/L), range 0.2 to 1.6 umol/L, in young children age 3-10 years. These values were relatively low even in children living in polluted areas. Many inner city children (particularly of the ethnic Asian minority) had raised blood lead concentrations<sup>23</sup> (>1.69). Another study from Kuwait reported<sup>24</sup> that 31% of children (age 3 months to 5 years) had blood lead levels above 25 ug/dl (1.2 umol/L) being the cutoff point for elevated blood lead levels. Blood lead levels have been reported in various population groups in Pakistan<sup>25-27</sup>. In a study from Karachi<sup>25</sup> the blood lead levels in children from two schools were much higher than in the present study (Table III).

Table III. Blood lead levels in school children in Karachi and Islamabad.

Groups	Sex	No.	Age (Years)		Blood lead levels (ug/dl)		Levels <20 ug/dl % Children
			Mean	(Range)	Mean	(Range)	
<b>Karachi</b>							
T.S.	M+F	42	10.9	(3-15)	38.2	(21.3-52.2)	Nil
K.G.S.	M+F	190	9.1	(4-18)	36.9	(10.4-100.9)	7.9
<b>Islamabad</b> (Present Study)	M+F	170	14.9	(13-19)	2.38	(0.2-8.6)	100

T.S. = Toronto School for Academic Excellence, Karachi.

K.G.S. = Karachi Grammar School.

High values among children in Karachi reflect the degree of lead exposure, though these children belonged to high socioeconomic class, living in posh localities of Karachi, as compared to the children in the present study who belonged to low income families and are residing in villages. The difference in values may be attributable to the atmospheric pollution in Karachi, where traffic exhaust fumes are clearly the major source of aerial pollution. The combustion of tetraethyl lead enriched gasoline is a potent source of atmospheric pollution<sup>25,26</sup>. In Islamabad, the vehicle exhaust is much lower and the children studied were residing away from the main city, in the relatively pollution free area of Chakshahzad. Chakshahzad is about 7km away from the main city (Aabpara Chowk). Murree Road passes between Chakshahzad and Aabpara is 2 km away from Aabpara and also 2 km away from Chakshahzad. The traffic load on this road is not as heavy as at Aabpara Chowk. Similarly the traffic on side road (linking Murree Road with Chakshahzad) is very low. The villages, where children reside, are about 8 to 20km away from the city. Another study from Islamabad<sup>27</sup> reported blood lead levels in 230 school children, aged 5 to 14 years, studying in a school near Quaid-e-Azam University, Islamabad. Mean blood lead level in this study was 22.8 ug/dl (ranged from 13 to 32 ug/dl), 23.0 ug/dl for boys and 22.5 ug/dl for girls. These values are also higher than present study, but lower than one reported from Karachi<sup>25</sup>. Details about the location of school and residence of children was not given in this study. However, the University is about 15 km from the main Aabpara Chowk, but the traffic load is high, as most offices and embassies are located on this road, and also due to the heavy traffic near the Bari Imam Mazar which is an adjacent area of Islamabad.

In Karachi, only a small percentage (7.9%) of children had levels <20 ug/dl and none of them had levels below 10 ug/dl, which is currently acceptable, no effect level (NOEL) for children<sup>21,22</sup>. The levels found in our study were comparatively low and we also found a significant sex difference. Low levels in girls may be due to less exposure to environment due to cultural reasons. As no data is available on lead levels in drinking water and soil, in different parts of the country, the reason for low blood lead levels in present study might be that in the Chakshahzad area the vehicle exhaust is lower. Further, the children of this study were of older age group and this may account for the lower exposure to dust particles.

Blood lead levels in young healthy children of Chakshahzad are relatively low, like values are representative of the population at large, they reflect very little or no risk to the health of children in Chakshahzad. The lower values observed also indicate the fact that the area of Chakshahzad is

relatively free from any lead pollution.

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