

Correlation of Blood Lead Level in Mothers and Exclusively Breastfed Infants: A Study on Infants Aged Less Than Six Months

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Abstract

Background: It has been shown that there is a partial correlation between blood lead level (BLL) of infants and their mothers. This study was designed to evaluate the BLL of exclusively breast-fed infants less than 6 months of age and their mothers.

Methods: This was a cross-sectional study on infants below 6 months of age and their mothers who were referred to Mashhad Imam Reza Hospital, Iran. BLL was determined by atomic absorption spectroscopy method. Demographic features and economic status of the subjects were also collected.

Results: Sixty infants and their mothers in total were studied and 76.7% of the infants were boy. Mean (SD) age of children was 24.6 (31.8) days. Economic status of 16.7% of subjects was evaluated to be "poor", 38.3% "middle" and 45% "good". All of the mothers were housewives. Most subjects (88.3%) were living in the urban areas, and the remainder (11.7%) in rural areas. Mean (SD) of mothers' BLL was 75.9 (31.1) µg/L. Mean (SD) of BLL in infants was 63.6 (26.8) µg/L. In 8 mothers (13.3%) and 4 infants (6.7%) BLL was higher than 100 µg/L. There was a significant relationship between BLL of infants and mothers ($P < 0.001$, $r = 0.64$). No significant correlation between maternal BLL and infants' age, infant birth weight and current infant weight was established. Mean BLL in male infants was 73.4 (25.4) µg/L and in female infants was 84.8 (45.3) µg/L which was not significantly different from each other. The relationship between economic status and infants' BLL was close to the level of significance ($P = 0.08$). Mean BLL in infants living in urban areas was 65.2 (27.1) µg/L, while in infants living in rural areas was 51.9 (23.3) µg/L; nonetheless, it was not significantly different between them ($P = 0.22$).

Conclusion: There was a direct relationship between BLL in exclusively breastfed infants and their mothers. This may ascertain that lead can be excreted to the breast milk. Also, it may also suggest that both mothers and children were exposed to same level of air lead pollution.

Keywords: Atomic Absorption Spectrophotometry; Exclusive Breastfeeding; Infants; Lead, Mothers

How to cite this article: Farhat A, Mohammadzadeh A, Balali-Mood M, Aghajanpoor-Pasha M, Ravanshad Y. Correlation of Blood Lead Level in Mothers and Exclusively Breastfed Infants: A Study on Infants Aged Less Than Six Months. *Asia Pac J Med Toxicol* 2013;2:150-2.

INTRODUCTION

Lead is a harmful xenobiotic to humans. The most common sources of lead exposure are classified as environmental and occupational (1,2). Environmental exposures can affect the entire population, particularly young children and even infants (3). In adults, 5 to 10% of the lead in contaminated food is absorbed by the digestive system and this rate is higher in children, which is approximately 40% (4). Lead can be distributed through blood circulation to different organs and tissues. Then, gradually can be redistributed to create a flexible structure and highly concentrated storage particularly in bones. In most cases it can be stored in radius, tibia and femur (2,5). Lead toxicity can induce bone marrow suppression that can cause anemia. It can also damage central nervous system that can induce persistent cognitive deficits and neurologic effects (1-4,6). Ingestion of lead contaminated food in

children can cause a metallic taste sensation, abdominal pain, vomiting, diarrhea, colorless stool, loss of appetite, irritability, fatigue and shock (3). Neurological disorders, including headache, insomnia, somnolence, and seizures are also common (4,6,7).

In previous studies, it has been ascertained that there is a partial correlation between blood lead level (BLL) of infants and their mothers and also between infant age and maternal job (8). Although there are screening programs on children's BLL in western countries to reduce the potential toxicity of this substance (3), lead poisoning in children has been neglected in Iran. This study was designed to evaluate the BLL of exclusively breast-fed infants less than 6 months of age and their mothers.

METHODS

This was a cross-sectional study on 60 infants below 6 months of age and their mothers who were referred to

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Received 28 August 2013; Accepted 3 October 2013

Mashhad Imam Reza Hospital, Iran. The study was performed according to the Helsinki Declaration and informed consents were obtained from fathers of the infants and the mothers. Four milliliter heparinized blood was obtained from mothers and their children. BLL was determined in the toxicology laboratory of Imam Reza Hospital by atomic absorption spectroscopy method (Perkin-Elmer, Waltham, USA). Demographic features and economic status of the subjects were entered into a predesigned checklist.

Based on self-declared income of fathers of the infants, economic status of the subjects was graded according to the official poverty line announced by the Iranian Central Bank. If the income was less than 80% of poverty line, the economic status was graded as poor. If it was between 80% and 120% of poverty line, then the economic status was graded as middle. Those who had income of higher than 120% of poverty line were graded as having good economic status.

Data analysis was done with Student's t-test, chi-square and Pearson's correlation coefficient tests using SPSS software (SPSS Inc., Chicago, USA). P values of less than 0.05 were considered as significant.

RESULTS

Sociodemographic Features

Sixty infants and their mothers in total were studied and 76.7% of the infants were boy. Mean (SD, min-max) age of children was 24.6 (31.8, 4-150) days. Eighty percent of infants were below one month of age and 20% were between 1 and 6 months. Mean (SD, min-max) birth weight of infants was 3.1 (0.4, 2.0-4.2) kg. Mean (SD, min-max) of current weight of infants was 3.7 (1.0, 2.0-7.1) kg. Economic status of 16.7% of subjects was evaluated to be "poor", 38.3% "middle" and 45% "good". All of the mothers were housewives. Most subjects (88.3%) were living in the urban areas, and the remainder (11.7%) in rural areas.

Laboratory findings

Mean (SD, min-max) of mothers' BLL was 75.9 (31.1, 23.0-208.0) $\mu\text{g/L}$. Mean (SD, min-max) of BLL in infants was 63.6 (26.8, 20.0-178.0) $\mu\text{g/L}$. In 8 mothers (13.3%) and 4 infants (6.7%) BLL was more than 100 $\mu\text{g/L}$.

Analysis of correlation

Correlation analysis showed that there was a significant relationship between BLL of infants and mothers ($P < 0.001$, $r = 0.64$). A significant relationship also observed between BLL of infants below one month and their mothers ($P < 0.001$, $r = 0.70$) (Figure 1). However, in group of infants more than one month, this association was not found ($P = 0.181$). Moreover, no significant correlation between maternal BLL and infants' age ($P = 0.57$), birth weight ($P = 0.14$) and current infant weight ($P = 0.94$) was established.

Mean BLL in male infants was 73.4 (25.4) $\mu\text{g/L}$ and in female infants was 84.8 (45.3) $\mu\text{g/L}$ which was not significantly different from each other ($P = 0.25$). The relationship between economic status and infants' BLL was close to the level of significance ($P = 0.08$). Mean BLL in infants living in urban areas was 65.2 (27.1) $\mu\text{g/L}$, while in infants living in rural areas was 51.9 (23.3) $\mu\text{g/L}$;

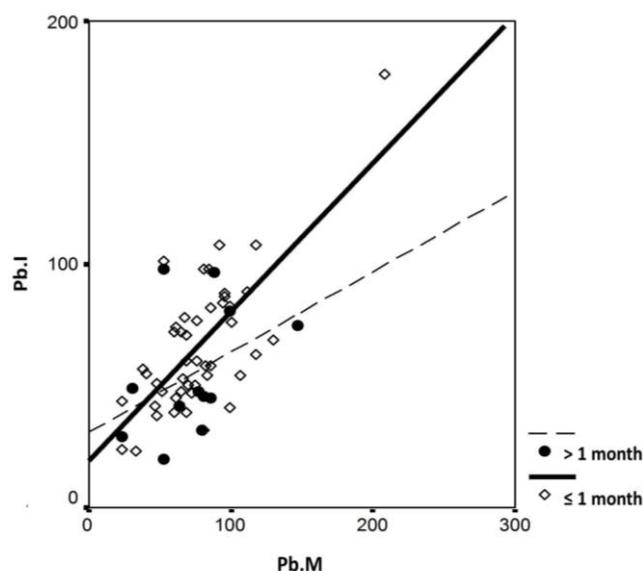


Figure 1. Correlation of infants' blood lead level (Pb.I) with mothers' (Pb.M).

nonetheless, it was not significantly different between them ($P = 0.22$).

DISCUSSION

Lead contamination is an environmental threat to human health. In this study, we found significant correlation between maternal and infants' BLL. The mean maternal and infants' BLL in the present study was comparatively higher than a study conducted in Australia (9). McMichael et al. in a study on 831 pregnant women living around a lead smelting plant in South Australia, found that mean BLL of these women at 14-20 weeks of gestational age was 10.6 $\mu\text{g/L}$, while at the same time this level in women who lived in other areas was 7.6 $\mu\text{g/L}$ (9). Correspondingly, in our study BLL in infants who lived in urban areas which are surrounded with several industries and are having lead polluted air due to incomplete combustion of car fuels was higher than those who lived in rural areas though the difference was not significant. Likewise, Hallén et al. showed that lead level in breast milk of mothers who lived in vicinity of a smelter workshop was significantly higher than mothers who lived in remote areas (10).

In the present study 6.7% of infants and 13.3% of mothers had BLL of over 100 $\mu\text{g/L}$. In the United States this rate is lower (11). Conversely, in a study on children aged 1 to 7 years in Mashhad, the BLL of over 100 $\mu\text{g/L}$ was found considerably higher (75%) than our study (12). In a study done in central part of Iran (Semnan) also the same result was found showing BLL of over 100 $\mu\text{g/L}$ in 78.8% of children aged 6 to 11 years (13).

In this study, we showed a significant correlation between mothers' and infants' BLL. Similarly, in a study on 255 mothers and their infants under one month of age, Ettinger et al. showed that in spite of low levels of lead in mothers' breast milk, BLL of infants and mothers were significantly correlated (14). Chen et al. also showed the same correlation (8).

Table 1. Mean blood lead levels in infants according to sociodemographic factors

	Blood lead level, mean (SD)	P value
Gender		
Male	73.4 (25.4)	0.25
Female	84.8 (45.3)	
Economic status		
Poor	94.2 (14.9)	0.08
Middle	76.8 (5.49)	
Good	68.5 (4.9)	
Place of residence		
Urban	65.2 (27.1)	0.22
Rural	51.9 (23.3)	

The explanation of this correlation can be that the lead excretes to mothers' milk. In this regard, Gulson et al. showed an association of infant's BLL with lead level in mother's breast milk (15). Nevertheless, in most studies the level of lead in breast milk was shown to be very low (10,14,15). Hence, the other reason for this correlation can be that the infants breathe the same air as their mothers do. In this respect, some studies showed the direct impact of lead-polluted air on BLL in all age groups (16,17).

LIMITATIONS

The value of findings can be limited with the methodology of this study. More reliable results and conclusions could be obtained if a control group of formula-fed infants were included in this study.

CONCLUSION

There was a direct relationship between BLL in exclusively breastfed infants and their mothers. This may ascertain that lead can be excreted to the breast milk. Also, it may also suggest that both mothers and children were exposed to same level of air lead pollution.

ACKNOWLEDGEMENTS

We would like to thank the staff of neonatal intensive care unit of Mashhad Imam Reza Hospital for their cooperation.

Conflict of interest: None to be declared

Funding and support: This study was supported by the vice presidency for research of Mashhad University of Medical Sciences, Mashhad, Iran.

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