Lead concentrations in early human milk of urban and rural mothers

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Summary

The aim of this study was to determine and compare lead concentrations in breast milk between urban and rural women. Colostrum from 51 women living in the city of Thessaloniki (exposed to increased air lead concentration, 0.54 μg/m^3) and from 40 women living in rural areas (exposed to significantly lower air lead concentrations) was analyzed by atomic absorption spectrometry. Urban women showed slightly higher lead concentrations (mean ± SD: 0.090 ± 0.029 μg/ml) than rural women (mean ± SD: 0.084 ± 0.024 μg/ml). This difference was not statistically significant. These results suggest that the lead content of human milk is not influenced by the concentrations of this enviromental pollutant in the air.

Key words: Human milk; Lead; Air pollutants; Heavy metals.

Introduction

Increased urbanization and industrialization have resulted in atmospheric pollution and concomitant health problems. Lead as a persistent atmospheric pollutant of considerable developmental toxicity, deserves special attention.

During the last 25 years there has been a growing body of evidence that lead exposure is associated with deficits in infant's growth during the first year and children with high blood lead levels are at risk for neuropsychological deficits [1, 2, 3].

Breast milk is the ideal nutrient for the newborn, but unfortunately also a possible route of excretion for lead. Given that a proportion of total lead intake occurs through inhalation of either air particulates containing lead, or automobile exhaust, it might be interesting to evaluate the influence of atmospheric lead pollution on human milk in a heavy traffic city.

Material and Methods

Ninety-one healthy women, aged 18-41 years, were enrolled in the study. Fifty-one of the subjects (Group I) were living in the city of Thessaloniki and the remaining 40 (Group II) were from rural areas. It should be noted that air lead concentrations in the city of Thessaloniki, an industrial heavy traffic city with one million inhabitants, has ranged from 0.54 to 0.67 μg/m^3 in the past two years. On the contrary, air concentrations of this pollutant were 15-fold lower in the studied rural regions. These measurements were carried out by the Ministry of Macedonia and Thrace, Northern Greece. All the examined mothers delivered "per vias naturales" 91 normal neonates. The duration of pregnancies varied from 37 to 41 weeks and the mean parity was 1.8.

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On the 4th to 5th day of their uneventful puerperium, the mothers were instructed to collect, approximately 10 ml of milk in acid-washed lead-free polystyrene containers. Between 9 a.m. and 1 p.m. milk was drawn either manually or by a hand pump under supervision of the nursing staff. Milk samples were stored at a temperature of -20°C until analysis. Before the analyses, milk proteins, including casein, were precipitated using trichloroacetic acid and the samples were filtrated. Lead concentration of the filtered samples was then determined by graphite atomic absorption spectrometry. A Perkin Elmer 2100 spectrometer was used.

Means and standard deviation (SD) were calculated and the two groups were compared by the Student t-test.

Results

The distributions of lead concentrations in the milk of the 51 urban women (Group I) and 40 rural women (Group II) are illustrated in Figure 1. The mean lead concentration of the urban samples was 0.090 ± 0.029 μg/ml and the determined values ranged from 0.050 to 0.250 μg/ml. On the other hand the mean lead concentration of the rural samples was 0.084 ± 0.024 μg/ml and the determined values ranged from 0.050 to 0.140 μg/ml.

Although urban women showed slightly higher lead concentrations in breast milk than rural women, the difference was not statistically significant.

Discussion

According to previous studies lead concentrations in human milk range widely from 0.008 μg/ml to 0.126 μg/ml [4-13]. The findings from our study are consistent with this overall picture. Although there appears to be a large range of lead values from all the studies, none of them singularly constitutes a threat to the breast-fed neonates. Taking into account that the average daily milk

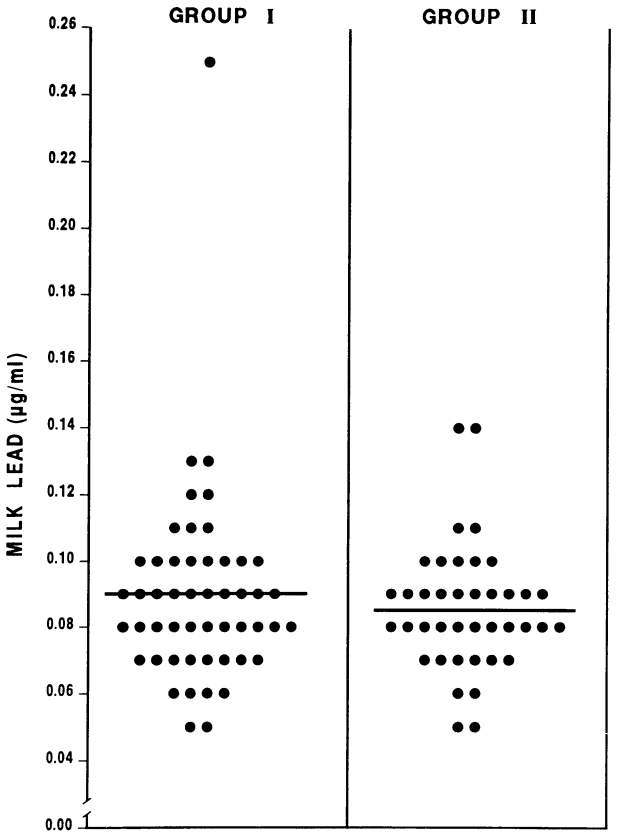

Figure 1. — Lead content of breast milk in urban mothers (Group I) and rural mothers (Group II). The solid lines indicate mean values.

volume for 4-day-old neonates (mean body weight 3,200 gr) was 360 ml and that the neonates fed solely on breast milk, our data suggest that the mean dietary lead intake amounted to 10.1 µg/kgr/day for urban babies and 9.4 µg/kgr/day for rural ones. The estimated lead intakes for both the urban and rural groups are well below the tolerable or maximal daily lead intake proposed by the National Research Council of the U.S.A. [14] and the World Health Organization [15]. They are also below the figures Mahaffey recommended as a maximum allowable intake [16].

In our study the urban population (exposed to significantly higher air lead concentrations) had higher values of lead in colostrum than the urban population; the difference, however, was not significant. It should be noted that none of the women had any history of occupational exposure to lead and that there was no difference in the dietary habits between the two groups. Data on this subject are contradictory. The majority of previous data support the view that women living in urban areas with heavy road traffic and industrial activity have breast milk lead levels significantly higher than women living in rural areas [8, 12, 13]. On the contrary, other authors suggest that there is no correlation of breast milk lead concentrations with location [5]. The latter could be attributed to the finding that there is not a significant positive correlation between blood lead levels and milk lead levels [9], as well as that blood lead levels of lactating women, as reported by Rockway *et al.* [17] do no correlate with urban or rural locations of the subjects.

In conclusion, it seems that the lead content of human milk is not influenced by the concentrations of this environmental pollutant in the air. Furthermore, it does not appear that breast-feeding infants are at any risk of lead exposure via milk.

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