

## **LEAD TRANSPORT THROUGH HUMAN MEDIA**

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### **Abstract**

The quality of environment is noticed best through contaminant concentrations in it. Therefore, the authors of this paper decided to analyse body liquids and tissues sensitive to certain element or their ability to accumulate it. Determination of lead concentration in samples of placenta, umbilical cord blood and amniotic fluid of pregnant women from Kikinda and Novi Sad regions as well as in control group was carried out. The obtained results were statistically processed and correlated both in relation to location and medium.

Key words: Lead, placenta, umbilical cord blood, amniotic fluid.

### **Introduction**

Lead is introduced into the human body mainly through food, water, air and dust, and that is why the environment is one of the essential factor dictating the level of lead deposit in the body. Absorbed lead is distributed in the body in three media: blood, soft tissues, mineral tissue (bones and teeth). Out of the total lead quantity deposited in the organism, only 2% are found in the blood [1,2] mainly bounded to erythrocytes (95%) or in plasma. Lead ions, bounded with tiol and phosphate ligands on cell membrane, effect the membrane permeability so that lead increases fragility of erythrocytes and erythroblasts. Biological half-life of lead in the blood can be very short and it is estimated to 20 up to maximum 40 days, depending on the lead concentration in the body. The first group of increased risk from the exposure to lead as well as its negative effects on health are manifested with children up to the age of 6. The reasons are children's behaviour habits, then food consumption per body weight unit which is more common with children than with adults and so absorption of lead from gastrointestinal tract is significantly higher with children [3,4,5]. Nutritious deficiency ( e.g. iron and vitamin D ) is more spread with children, which increases the lead absorption from gastrointestinal tract and with very young children, since their blood and brain barrier has not been yet developed, hematology and neurology effects of lead influence on the body are manifested on the lower initial levels than with adults [6]. Since placenta is not effective biological barrier, pregnant women represent the group of increased risk due to fetus exposure to lead [5,7]. Lead is rapidly transferred from mother to fetus during pregnancy and accumulated in bones during the growth [8, 9]. Lead concentration in the umbilical cord blood achieves up to 85-90% of lead concentration value in the mother's blood [4,10,11].

## Materials and methods

Collecting of placenta tissue, amniotic fluid and umbilical cord blood samples was performed after delivery of pregnant women living in the region of Kikinda or Novi Sad during pregnancy. In the region of Kikinda 31 samples of placenta, umbilical cord blood and amniotic fluid were taken and 30 from the region of Novi Sad. Samples of placenta, blood from umbilical cords and amniotic fluid were taken after delivery of pregnant women living in Kikinda or Novi Sad region during pregnancy in the period of 1996-1997. 31 samples of placenta, blood from umbilical cord and amniotic fluid were taken from Kikinda region and 30 samples from Novi Sad region. Samples were prepared by pouring 5 mL of heparinized blood or 10 g placenta tissue or 5 mL amniotic fluid in the test tube for mineralisation. Then 10 mL of concentrated  $\text{HNO}_3$  and 5 mL of  $\text{H}_2\text{O}_2$  were added and destroyed to wet residue. When the residue was cooled, 5 mL of 6M HCl was added followed by the addition of 10 mL diethyl ether. After adding diethyl ether the emulsion should be separated into layers. Ether layer is to be discarded. Lower water-acid layer is evaporated almost to dry. The residue was dissolved in a small quantity of redistilled water where 1-2 drops of concentrated  $\text{HNO}_3$  were added and then quantitatively carried to measuring tube. Determination of lead concentration was performed on atomic absorption spectrometer ("PERKIN-ELMER" model 5000, HGA-400) [12, 13]. Lead concentrations below 0.01 mg/L were determined using graphite furnace at wavelength of 283.3 nm; concentrations above 0.01 mg/L were measured in flame at wavelength of 217 nm.

In the statistic analysis, methods of central tendency (arithmetic mean  $\bar{x}$  and standard deviation – SD) were used and the level of statistic importance was determined (student t-test).

## Results and discussion

Lead concentration in placenta tissue samples of pregnant women from the region of Kikinda ranged from 0,099 to 0,464  $\mu\text{g/g}$ , with mean value of 0,206 $\mu\text{g/g}$ . Lead concentration value in placenta of pregnant women from the region of Novi Sad ranged from 0,095 to 0,296  $\mu\text{g/g}$  with mean value of 0,164  $\mu\text{g/g}$ . With probability of certainty of 95% it can be stated that values ranged from 0,176 to 0,235 $\mu\text{g/g}$  for the samples from Kikinda and from 0,145 to 0,184  $\mu\text{g/g}$  for the samples from Novi Sad. By distribution of measured values it can be concluded that about 60% of the analysed samples have values below average. Median value of lead concentration in all examined placenta samples was 0,186  $\mu\text{g/g}$  and with probability of certainty of 95% it can be stated that median values ranged from 0,16 to 0,204  $\mu\text{g/g}$ . It is essential to stress that mean value of lead in placenta samples from Novi Sad is 2% lower than the one taken from Kikinda

Determined values of lead concentration in umbilical cord blood of new born children from Kikinda Maternity Hospital ranged from 0,222 to 0,348  $\mu\text{g/mL}$ , and in samples from Novi Sad from 0,120 to 0,208  $\mu\text{g/mL}$ . In both cases median value is almost equal to average value indicating the uniform distribution of values between minimum and maximum. Average value of all analysed samples from both regions was 0,175  $\mu\text{g/mL}$  and with probability of certainty of 95% it can be concluded that average values ranged from 0,133 to 0,218  $\mu\text{g/g}$ . However, it is essential to stress that average values of lead concentration in umbilical cord samples from Novi Sad is 42% lower in relation to average value from Kikinda.

According to recommendations from U.S.A Disease Control Centre (1978), the values above 0.25  $\mu\text{g}/\text{mL}$  are considered to be extremely high lead concentrations in the umbilical cord blood [14]. In Kikinda region in 50% samples lead concentration was above the extremely high values and in Novi Sad none of the obtained values of lead concentration exceeded 0.25  $\mu\text{g}/\text{mL}$ .

Lead concentration in amniotic fluid of pregnant women in Kikinda ranged from 0,033 to 0,467  $\mu\text{g}/\text{mL}$  with average value from 0,223 $\mu\text{g}/\text{mL}$ . Lead concentration values in the amniotic fluid samples of pregnant women in Novi Sad ranged from 0,059 to 0,365  $\mu\text{g}/\text{mL}$  with average value of 0 230  $\mu\text{g}/\text{mL}$ . With probability of certainty of 95% it can be stated that average values of the samples from Kikinda ranged from 0,176 to 0,270  $\mu\text{g}/\text{mL}$  and in the samples from Novi Sad they ranged from 0,192 to 0,269  $\mu\text{g}/\text{mL}$ . Average value of the samples from both regions was 0,226  $\mu\text{g}/\text{mL}$  and with probability of certainty of 95% it can be stated that it ranged from 0,195 to 0,257  $\mu\text{g}/\text{mL}$ . Analysing the distribution of obtained results it can be found that median and average value are approximately similar for the samples from Novi Sad whereas over 60% of the samples from Kikinda have values lower than average indicating unequal distribution of values between minimum and maximum.

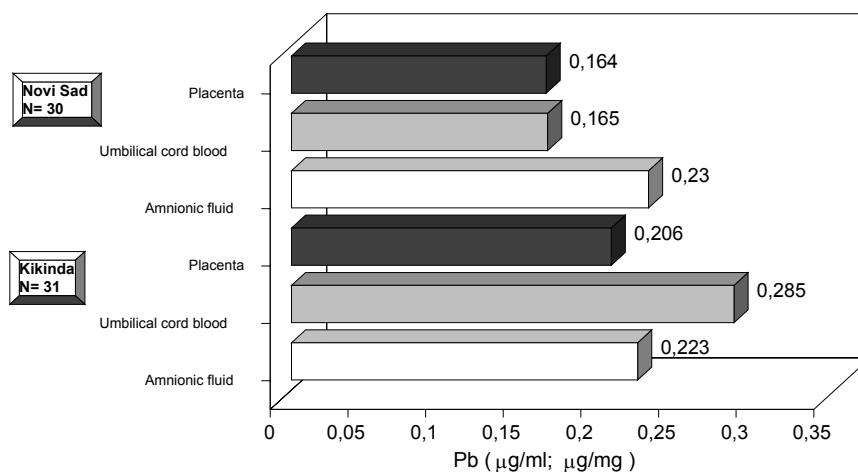


Figure 1. Mean values of lead concentration in relation to media and town

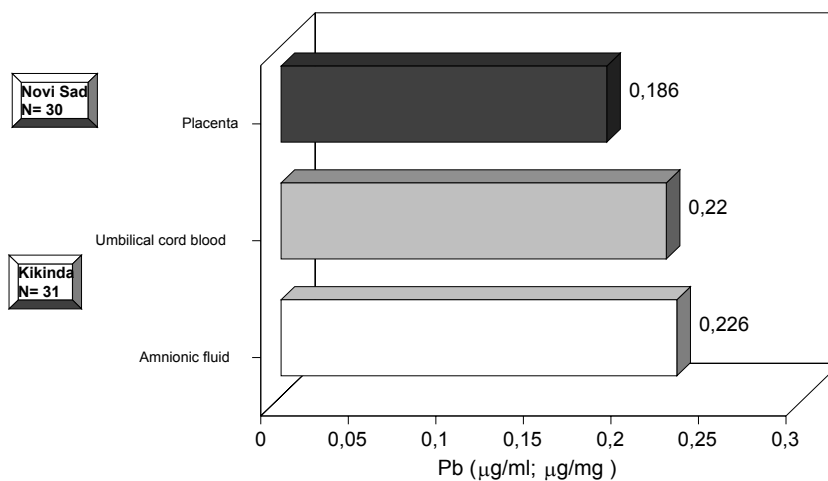


Figure 2. Mean values of Lead concentration in relation to media

It has been noticed that average value of lead concentration in amniotic fluid samples from Kikinda is for 3% lower in relation to average values of the samples from Novi Sad.

In figure 1 average values of lead concentration in human media are compared in relation to medium analysis and town. On basis of obtained mean values of lead concentration it is observed that lead values in placenta and umbilical cord blood is significantly higher in the samples from the region of Kikinda in relation to Novi Sad, which is statistically an important difference.

Figure 2 shows average values of all analysed samples indicating that there is no barrier to lead transfer from mother to fetus.

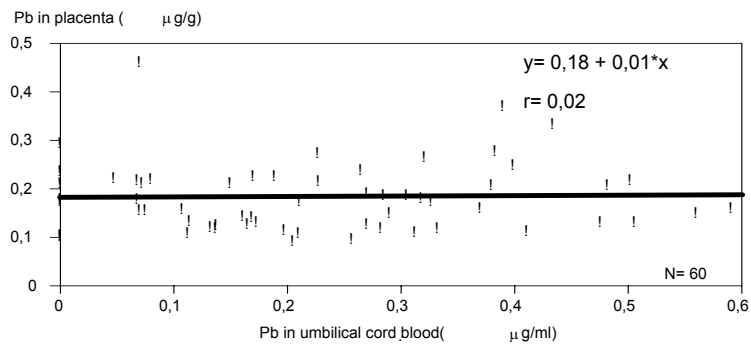


Figure 3. Lead correlation in umbilical cord blood and placenta

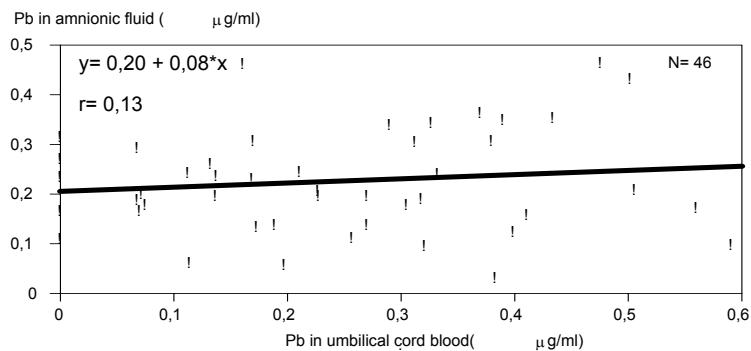


Figure 4. Lead correlation in amniotic fluid and umbilical cord blood

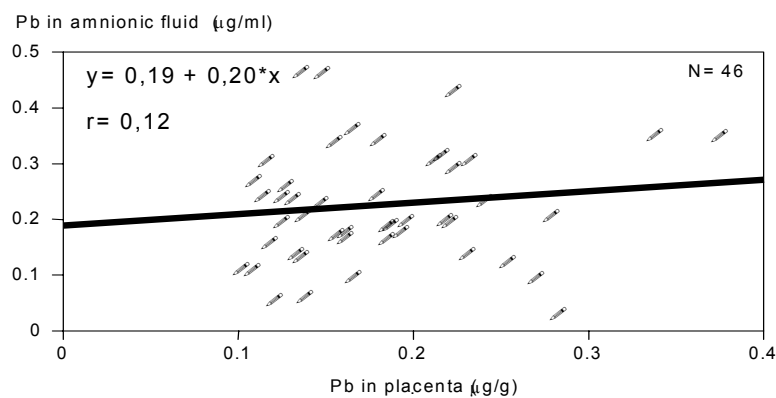


Figure 4. Lead correlation in amniotic fluid and placenta

Figures 2,3 and 4 illustrate correlation of lead values between media. Correlation coefficient shows that there is no statistically significant correlation between analysed values.

## Conclusion

The evidence that the environment is one of the essential factors which dictate the level of lead deposit in the body is the result of investigation of lead concentration in placenta, umbilical cord blood and amniotic fluid samples. The values of these results show significant differences depending on location. Although the traffic in Novi Sad is more developed, lead concentration in human media samples in Kikinda is higher indicating that besides traffic there are other lead emitters. It can be concluded that obtained lead concentration values are not in correlation when the relation between media is the matter. On basis of lead concentration in these media it can be concluded that placenta is not biological barrier to lead transfer from mother to fetus.

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