

## THE INTERACTION IN THE SYSTEM MOTHER-PLACENTA-FETUS IN THE CONDITIONS OF EXOGENOUS INFLUENCE OF PLUMBUM

Shybina O.S., Kireeva U.V., Smertina N.A., Melnicova N.A., Gryslova L.V.,  
Gromova N.V.

*M.E. Evseev's Mordvinian State pedagogical institute*

In the model experiment was shown that introduction to the pregnant rats the acetate of plumbum in the dose of 45 mg/kg per day cause metastructure changes of placental barrier, which manifest themselves by refinement of cyto- and syncytiotrophoblast, vacuolization and clarification of cytoplasmic matrix, decomposition of mitochondrion, diminution of intercellular contacts between the cyto- and syncytiotrophoblast elements. Revealed abnormalities promote the appearance of placental insufficiency, which negatively affects at the development of posterities of white rats, at the forming of their liver and kidneys.

**Keywords:** white rats, the acetate of plumbum, placental barrier, metastructure, liver, kidneys

The aim of the work is the influence of acetate of plumbum to the metastructural reconstruction of placental barrier, morphological abnormalities of liver and kidneys of the white rats' posterities at the early postnatal ontogenesis. Received facts allow to make the assumption, that introduction to the pregnant rats the acetous plumbum in the dose of 45 mg/kg per day cause rather big metastructural changes of placental barrier, which are typical for the lead intoxication. Appearing changes cause the development of placental insufficiency, which negatively affects at the development of posterities of white rats, at the forming of their liver and kidneys.

The worsening of ecological situation nowadays is one of the main factors in the abnormalities of reproductive function of woman and the factor of risk for the baby's health [6]. Among the most dangerous anthropogenic pollutants of environment the leading position is hold by plumbum and its compounds [2, 3, 4]. At the same time a lot of questions are still not clear, including morphofunctional changes of placenta while the influence of plumbum, which lead to the abnormalities in the development of fetus and newborn [1, 5]. Thereby the examination of maternal-fetus relations in the conditions of lead intoxication needs the comprehensive and system approach.

### Materials and methods

The experiment was carried out with the observance of principles of humanity that were stated at the directions of European

community (86/609/EEC) and the declaration of Helsinki and due to the demands of rules of carrying out the works using experimental animals.

In the experiment there participated 10 sexually matured pedigreeless white rats-females with the weight of 200,0-250,0 g. And their 10 young rats on the 30<sup>th</sup> day of postnatal period of development. The first group of animals (control) was compiled from: 5 female physiologically pregnant, 10 young rats at the 30<sup>th</sup> day of postnatal period of development. These group of animals was situated at the general routine of vivarium. The second group (experiment) was compiled from: 5 females, who from the moment of revealing of embryo of labyrinth (8<sup>th</sup> day of pregnancy) daily peroral got the acetate of plumbum in the dose of 45 mg/kg of body weight, 10 young rats at the 30<sup>th</sup> day of postnatal period of development. All rats were decapitated under the ether narcosis.

For the electronically microscopic research the pieces of placenta were fixed in the 2,5% solution of glutaraldehyde to the 0,1M phosphate buffer (pH=7,2). Fixation was carried out in the 1% solution of osmic acid to the 0,2M phosphate buffer (pH=7,2). The embedding of material was carried out to the compound epon-araldite. The contrast of ultrathin section was carried out with the uranyl acetate and the citrate of plumbum. Received material was looked through the electronic microscope ЭМ-125.

For the microscopical research the material was fixed with the 10% solution of neutral formalin, and after the dehydration was embedded into the paraffin. Sections were prepared with the thickness of 5 micrometers and were dyed with hematoxylin and eosin.

The definition of the substance of plumbum in the placenta, liver and kidneys was carried out with the method of atomic absorption spectrometry. The degree of development of posterity was valued by the changes of their mass.

Numerical results were worked up statically with the use of t-criterion of Student and pair correlated analysis.

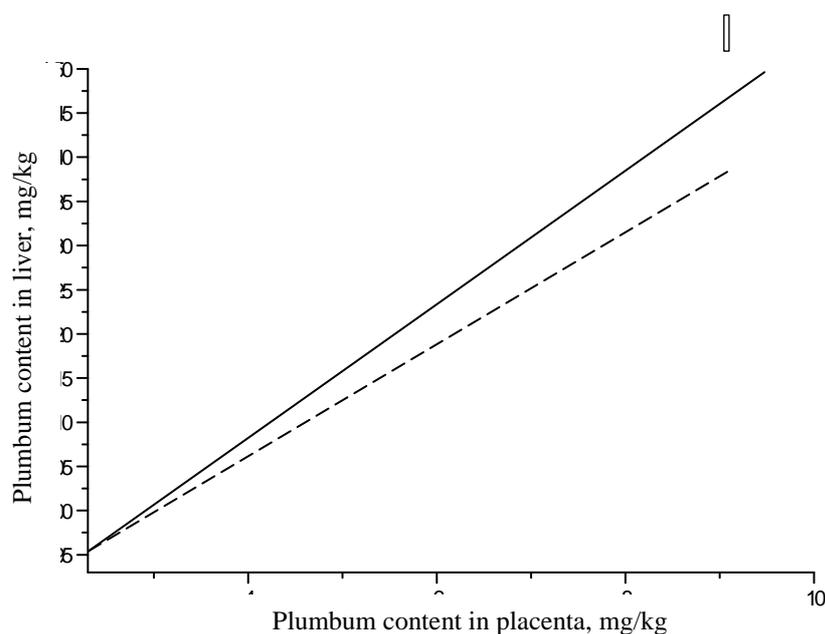
### Results and their discussion

Received with the help of atomic absorption spectrometry facts showed that in the control the substance of plumbum in the placenta of pregnant rats formed  $2,75 \pm 0,51$  mg/kg of natural weight, and in conditions of

lead intoxication –  $7,97 \pm 0,78$  mg/kg of natural weight ( $P \leq 0,002$ ), that 2,9 times more in compare with the intact animals.

30-days young rats of control group had the substance of plumbum in the liver  $0,95 \pm 0,069$  mg/kg of natural weight. The young rats of analogous age who had received acetous plumbum at the period of intrauterine development had the concentration of plumbum in the liver  $1,26 \pm 0,098$  mg/kg of natural weight ( $P \leq 0,05$ ), that 1,3 times more in compare with the control.

The substance of plumbum in the liver of 30-days young rats, which were born from rats with the physiological pregnancy, had very high affirmative correlation with its substance in the placentas. The coefficient of correlation was 0,731 ( $P < 0,05$ ). Young rats, mothers of which had taken the acetate of plumbum, had these affirmative dependence become stronger, and the coefficient of correlation was 0,828 ( $P < 0,01$ ) (fig. 1).



**Figure 1.** Correlation between the substance of plumbum in the placentas of rats and in the liver of their posterity at the 30<sup>th</sup> day of postnatal development

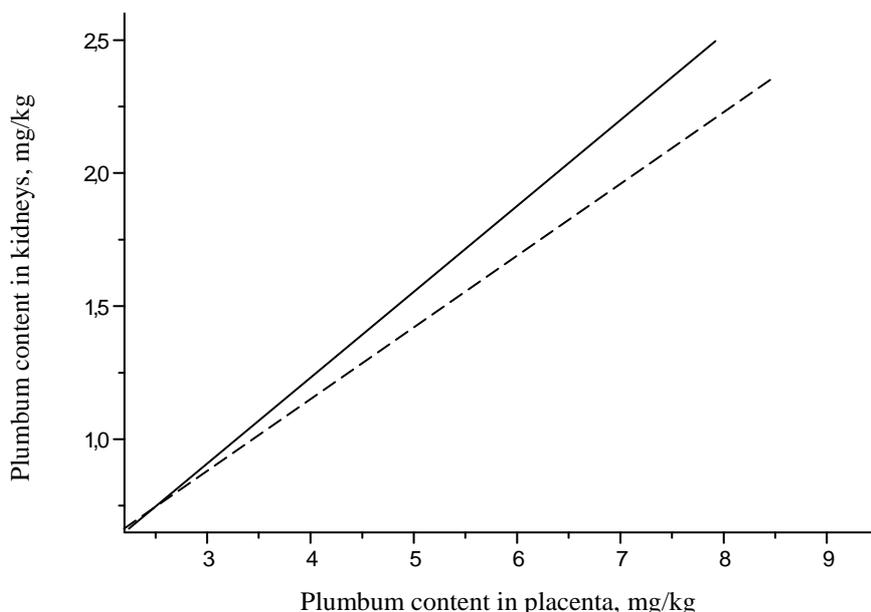
----- – control (physiological pregnancy),  
 \_\_\_\_\_ – experimental (lead intoxication of female)

In the control in the kidneys of young rats the substance of plumbum was  $0,80 \pm 0,087$  mg/kg of natural weight, in the experiment –  $2,56 \pm 0,410$  mg/kg of natural

weight ( $P \leq 0,01$ ), what 3,2 times more in compare with the young rats, who was born by intact females.

The substance of plumbum in the kidneys of posterity, born by the rats with the physiologically pregnancy, also had high af-

firmative correlation with its substance in the placenta. The coefficient of correlation was 0,754 ( $P < 0,01$ ). Young rats, mothers of who had received the acetate of plumbum these dependence were more manifested and was 0,887 ( $P < 0,001$ ) (fig. 2).



**Figure 2.** Correlation dependence between the substance of plumbum in the placenta of rats and in the kidneys of their posterity at the 30<sup>th</sup> day of postnatal development  
 ----- – control (physiological pregnancy),  
 \_\_\_\_\_ – experimental (lead intoxication of female)

The accumulation of plumbum in the organs of young rats of experiment group testify to its passing through the placenta from the mother's blood to the fetus. As the researches showed in the conditions of lead intoxication of mother organism the greatest occurrence of plumbum posterity has in the kidneys, what is connected with their high sorption activity.

Electronically-microscopic researches showed that daily introduction to the pregnant females of white rats the acetous plumbum in the dose of 45 mg/kg leads to the derangement of compensatory mechanisms of placental barrier, which is expressed by the refinement of the cyto- and syncytiotrophoblast, vacuolization and clarification of cytoplasmic matrix, decomposition of mito-

chondrion, diminution of intercellular contacts between the cyto- and syncytiotrophoblast elements. Against the background of edema and destruction of trophoblastic structures of labyrinth zone of placenta it was observed the presence of regions with the numerous osmiophil formations, apparently which were the deposits of plumbum.

Microscopical researches showed that 30-days young rats of experiment group had the plethoric tissues of liver, liver's beams are saved, but along the periphery from the central veins their structure is "diffused". In the same zones were observed hepatocytes with the powdered, in the same places atomized fat dystrophy. The form of hepatocytes is varyable, sometimes were found hypertrophied cells. The nucleuses of cells of round

shape, hyperchromic with the reticulate structure of chromatin. The cytoplasm is swelled, grainy nature, some places has single small transparent and semitransparent vacuoles. Intralobular sinusoid capillaries are insignificantly widen (edema), filled with serous liquid. The lumens of the majority of central and interlobular veins have the erythrocytes. It was observed the fibrosis of the central veins' walls. In the portal tracts were found the areas of ill-defined lymphohistiocytic infiltration.

In the kidneys of 30-days young rats of experiment group was found the abnormality of nephritic haemodynamics, dystrophically-moronic changes of epithelium of canaliculuses. There was observed the widening and hyperemia of vessels of cortex of kidney, the substance in them partially laky erythrocytes. In the epithelium of nephritic canaliculuses was found necrobiosis and necrosis of separated groups of cells. The interfaces of other epitheliocytes are diffused. The nucleuses of these cells are of round shape, with the friable reticulate chromatin. In the some nucleuses are visible small hyperchromic grains – the mark of possible reksis of nucleuses. In the lumen of certain nephritic canaliculus are founded transparent masses, possibly of hyaline. In the lumen of other canaliculus are found the accumulations of destroyed epithelial cells.

The observations of the development of the posterity of white rats showed, that the mass of young rats at the 30<sup>th</sup> day after birth while the physiological pregnancy was  $41,54 \pm 1,16$  g, and in conditions of lead intoxication –  $37,46 \pm 1,77$  g ( $P \leq 0,05$ ), that is 9,82 % less than control indicators.

### Conclusion

The results of research showed that the introduction to the pregnant rats the acetous plumbum at the dose of 45 mg/kg leads to the derangement of compensatory mechanisms

of placental barrier, cause in the liver and kidneys of posterity the hemomicrocirculation abnormalities and dystrophic changes.

The decrease of the body weight of posterity of white rats apparently connected with that plumbum when it accumulates in the organisms of animals, demand the considerable expenditure of energy on its elimination, and also can be the result of abnormalities of metabolic, transport and other functions of learnt organs, which are extremely important for the guaranteeing of normal development of organism.

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