

Experience of the using natural sorbents as a preventive food

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Резюме. Увага спеціалістів прикута до різних напрямків до оцінки впливу важких металів (ВМ) на організм людини з метою профілактики негативних наслідків та збереження здоров'я що має особливе значення для населення промислових територій. У зв'язку з тропністю ВМ навколишнього середовища до репродуктивної системі вагітної жінки, проведені складні багатопланові дослідження, які дозволили в натурних умовах Дніпропетровського регіону оцінити застосування біопротекції негативного впливу металевого навантаження з використанням пектинвміщуючих харчових добавок. Для проведення пектинопротекції за результатами попередніх обстежень було відібрано 40 жінок – мешканок дослідних районів м.Дніпро, у крові яких визначали перевищення концентрацій токсичних металів – свинцю і кадмію відносно існуючих нормативів або на рівні металонасиченості (вище 0,2 мкг/мл). Оцінка ефективності застосування пектинопротекції негативного впливу ВМ на організм проводилась у вагітних жінок шляхом порівняння даних біомоніторингу, показників порфіринового обміну до і після вживання пектинвмісних добавок – «драже пектинового», виробленого Асоціацією "Сума технологій" м.Київ. Після тритижневого вживання драже пектинового середня концентрація свинцю та кадмію в крові жінок статистично достовірно зменшилась на 25-30%, що спостерігалось у 50-80% обстежених жінок при достовірному посиленні реальної елімінації металів-токсикантів на фоні зниження активності маркера токсичної дії свинцю – амінолевулінової кислоти.

Використання пектинопротекції сприяло зниженню вмісту у крові свинцю та кадмію при посиленні їх ренальної елімінації, а також відновленню метаболізму

мікроелементів в організмі вагітних, що розцінюється як позитивний результат, який буде сприятиме підвищенню адаптації жінок в у умовах промислових міст.

Ключові слова: важки метали, вагітні жінки, пектинопрофілактика

Summary. The attention of specialists is focused on different areas direction of the impact of HM on the human body for the prevention of the negative consequences and preserve health. It is particular importance for the population of industrial territories. Due to the tropism of the HM of the environment to the reproductive system of the pregnant woman, complicated multidimensional research has been carried out. It allowed to assess the use of bioprophylaxis of the negative effects of the metal loading in the Dnipropetrovsk region using pectin-containing nutritional supplements. According to the results of previous surveys or pectin prophylaxis 40 women - residents of the experimental regions of Dnipro city were selected, whose blood levels were determined by the excess of concentrations of toxic metals - lead and cadmium according to current norms or at the level of metal carriers (above $0.2 \mu\text{g} / \text{ml}$). The estimation of the effectiveness of pectin prophylaxis of the negative effects of VM on the body was carried out in pregnant women by simile of the data of biomonitoring, porphyrin metabolism indices before and after the use of pectin containing additives - "Pectic Pill", produced by the Sumy Technologies Association in Kyiv. After three weeks of taking pectic dragee, the average concentration of lead and cadmium in the blood of women was statistically significantly reduced by 25-30%, which was observed in 50-80% of the examined women with a significant increase in the real elimination of metal-toxicants against the background of decreased activity of the toxic marker of lead - aminolevulinic acid.

The use of pectin prophylaxis promoted to decrease the content of lead and cadmium in blood when renal elimination increased and also to repair of metabolism of trace elements in the body of pregnant women. It is regarded as a positive result, which will increase the adaptation of women in the conditions of industrial cities.

Keywords: heavy metals, pregnant women, pectinoprophylaxis.

Introduction. Now the population of our country exists in the other living conditions compared with the previous generations. Chronic effects of it can be reflected in the basic biological characteristics of the population: the state of the gene pool, health, and the possibilities of adaptation. The increased risk of the spontaneous abortions, infertility, the birth of children with the congenital malformations, an increased reproductive losses, the reduction of the anthropometric indices at the birth, reduction of the proportion of the persons of the reproductive ages was determinanted [1,c.1-2; 2,c.144-148]. The main focus of the efforts to preserve and strengthen the reproductive health of the population is the improvement of the way of people's life and the environment [3,c.71; 4,c.80]. The deteriorations of the reproductive health of the population of the industrial regions appear as a result of the influence of the toxicants of the environment. The real danger of the anthropogenic stress of the environment and the negative impact on the human health is determined primarily with the chemical pollutants. The emissions of the industrial enterprises, transport, the using of the agrochemicals is the main cause of the environmental pollution. In this regard, the most illustrative example is the Dnipro region of Ukraine, where the greatest number of the environmental man-made pollution sources is concentrated. The extremely dangerous xenobiotics include the heavy metal (HM), which is included by the FAO/WHO commission in the list of those which must be under the control, among which the heavy metals (HM) occupy the important place [5,c.87-88; 6,c.236-238]. They have stability, global prevalence, duality of the bioeffects, the ability to be accumulated in the human's organism and in the objects of the environment and in biosubstrates, which forms the health risk even with the small concentrations of these xenobiotics [7,c.71-72; 8,c.2507-2508]. Due to this fact the increased attention of the specialists from the different fields about the assessment of the effects of HM on the human's organism to prevent the negative consequences and preserve the health is quite understandable. It has particular importance for the population of the

industrial territories. The hygienists offer a variety of the preventive measures, in the arsenal of which along with the radical ones, such as: technological, technical and sanitary hygienic, the nonspecific means of the individual bioprophylaxis, which are aimed to increase the human resistance to the harmful exposure of the HM are recently developed [4, c.91; 5,c.89-90].

The pectin-containing enterosorbents, because of which the pectinates of the metals are formed in the gastrointestinal tract with the further elimination from the body, has attracted our attention. The interest to pectins is based on the fact that they are the natural substances with a soft action, they are the part of the diet and can be considered as an element of a preventive diet, namely, as the correction of the diet with taking into account the impact of the adverse environmental factors and the risk of the health disturbing. The detoxification role of the pectins under the toxic effects of the metals is well studied in the professional contact and in the experiment, though, at present, there is a little data about the effectiveness of the usage of these bioprotectors in order to protect the human body from the influence of HM as a factor of the low intensity [4,c.95; 7,c.71-72; 9,c.23]

Aim. With reference to the tropism of HM to the reproductive system, we has estimated the effectiveness of pectin prevention measures of the pregnant women - residents of the industrial city - Dnepr.

Materials and methods. The data of our research during the long time of the observation (2001-2012y.) shows that there is the constant presence of HM in the objects of the environment of Dnipro city in the concentrations that are not exceeding the maximum of MAC. To assess the influence of the environmental HM on the bodies of the pregnant women, 89 20-25 aged practically healthy women, which has the second trimester of the pregnancy without the complications were selected. Women were divided into 3 groups taking into account the place of the permanent residence: the I group of women was from the

Industrial district of Dnipro, the II was from the Leninsky district of Dnipro, and the III one is from the Novomoskovsk (the city of the comparison).

The study of the influence of HM and the action of the pectin-containing drugs is accomplished with the help of the biomonitoring of the metals and the marker of the toxic action of the plumbum: the activity of the porphyrin metabolism enzyme - aminolevulinic acid (ALA).

Results. In the analysis of the findings of the HM content in the indicative biosubstrates of the pregnant women (residents of the industrial districts of Dnipro city), in reference to the standards, an increase of the plumbum concentrations in the blood - in 6.7-24%, in the urine - in 40-44.8%, cadmium in the urine - in 36-50% of the surveyed women were determined. At the same time, in the control group, only an excess of the cadmium in the urine of the pregnant women in 7.7% was observed. It is worrying that 60% of the pregnant women from the I group, 76.6% from the II group and 30% from the women from the city of comparison have the level of the plumbum in the blood which is determined as the so-called "alarming" concentrations - from 0.2 to 0.4 mg /l, which is estimated as metal carrying. Only 16% of the surveyed women of the Industrial district and 16.7% of the Leninsky one have the plumbum concentrations in the blood that correspond to the existing physiological standards, while in the conditions of Novomoskovsk city this indicator is much higher and makes up to 60%. As for cadmium, the metal carrying was determined for 96.7% of the pregnant women from the Leninsky district and 18% of the surveyed women from the Industrial district.

It should be noted that the average contents of the microelements in the blood of the examined groups of women are not significantly different. The concentration of copper and iron were in the existing physiological norms, but the content of zinc was in 2 times lower than the normal one. The concentrations of the essential metals in the urine of women of the 1st and the 2nd groups were significantly higher than in the urine of the women of the

comparative city. Conspicuous is the fact that against the background of the small amount of iron in the blood of the examined pregnant women of the Industrial district, its average concentration in the urine is 1.8-2.8 times higher than in the urine of the women of other areas of the observation.

The results of clinical and laboratory studies of ALA in the urine showed that its level was elevated in relation to the norm in 60.6% of the surveyed women from the Industrial district, in 50% from the Leninsky one and only in 26.9% of the women from the Novomoskovsk city. We have also established the excess of the average concentrations of ALA at the examination of the women in the industrial areas (2.86 ± 0.22 and 2.67 ± 0.25 mg/g of creatinine) on 14.4 and 7% relative to the norm, which coincides with the data of other studies of the anthropogenically contaminated areas [8,c.2510]. For the pregnant women from the comparative city, this value is significantly lower than it is for the residents of the industrial districts.

Discussion. The results of the first stage of the hygienic research of the content of HM in the environment in relation to the revealed violations of the porphyrin metabolism, the misbalance of the microelement composition of the blood of the pregnant women in the industrial districts of Dnipro city, compared with the surveyed control town, has led to the necessity of the individual bioprophylaxis of reproductive disorders to increase the adaptive capacity and the organism's resistance of the pregnant woman. The evaluation of the effectiveness of pectin prophylaxis of the negative effects of HM on the body was carried out in the pregnant women by studying and comparing the data of biomonitoring, porphyrin metabolism indices before and after the use of pectin containing additives - "Pectic Pill", produced by the «Sumy Technologies» Association in Kyiv.

For the pectin prophylaxis 40 women were selected from all the surveyed, of whom the two groups of the observation - residents of the experimental districts of the Dnipro city -

Industrial and Leninsky (20 women in each) - were formed. In the blood of these women the excess of the concentrations of toxic metals - plumbum and cadmium in relation to the existing norms or at the level of the metal carrying (higher than 0.2 µg/ml) was found up.

The results of the second stage of the research indicate that after three weeks of using the pectic dragee the average concentrations of plumbum and cadmium in the blood of both groups of women were statistically significantly decreased by 25-30. It was observed in 50-80% of the examined women with a significant increase in the real elimination of the metal-toxicants against the background decrease in the activity of σ -ALA.

After the use of pectin drugs the dynamic of the content of microelements in the body of the pregnant woman causes a special interest. Thus, the average concentration of Fe in the blood of women of the Industrial district has been statistically significantly increased by 2 times, with a decrease in urine by 49%, concentrations of conventionally essential metals - Mn, Cr, Ni - have been statistically significantly reduced in the blood by 2 times. The average level of Cu and Zn in the blood of the women in the industrial areas increased on 5-10%. Thus, the use of the pectins not only depresses the excretion of metals – microelements, more than that it reduces their excretion with its increased content in the blood.

Conclusions. The given data obtained after the carrying out of the course of peptic prophylaxis of the pregnant women indicates the effectiveness of the use of the proposed remedy. It reduces the absorption of abiotic HM and enhances their renal elimination from the body against the background of the normalization of the microelemental metabolism.

Taking into account the safety of the usage of pectin containing products for the human health and the absence of the contraindications, the introduction of preventive measures into the practice will reduce the technogenic stress on the organism of the inhabitants of the industrial territories, preventing the reproductive complications of the women, reducing the morbidity and strengthening the health of the population.

LITERATURE

1. Antimonova M. U., Vdovenko S. A., Churcan S. V. et al. Prevention of gestational complications: ways to solve the problem in the region by the example of anemia treatment of pregnant women. *Rus. med. jurnal.*2006; 14(7):1-3.
2. Golovkova T.A. Harmful effects of the environment xenobiotics on the human body. *Actual problems of transport medicine.*2016; N3(45):144-148.
3. Degtyareva T.D., Kaznelson B.A., Privalova L.I. et al. The use of biologically active substances in the prevention of toxic effects of certain heavy metals. *Hygiene and sanitation.* 2001;6:71-73.
4. Trachtenberg I.M., Tuchin V.A., Tamakin U.N. et al. On the problem of heavy metal transport. *Jurn. AMS Ukraine.*1999;5(1):87-95.
5. Trahtenberg I.M., Tuchin V.A., Sova R.E. et al. Basic Indicators of Human Physiology: Guidelines for Toxicologists. K.: «Aviczena»;2001:372.
6. Borodin U.I., Konontnikov V.I., Parmon V.N. et al. Biological properties of sorbents and prospects of their use. *Advances in modern biology.* 2014;134(3):236–248.
7. Polka N.S., Phedorenko V.I., Plastunov B.A. et al. Problems of preserving the environment and health of the nation in the materials of the XV Congress of Ukrainian Hygienists. *Environment and health.*2013; 2:68-80.
8. Zhang Y. L., Zhao Y. C., Wang J. X. et al. Effect of environmental exposure to cadmium on pregnancy outcome and fetal growth: a study on healthy pregnant women in China. *J Environ Sci Health A Tox Hazard Subst Environ Eng.*2004;Vol.39:2507-2515.
9. Serduk A.M. Genefund and health: reproduction of the population of Ukraine. K. MVC «Medinform»; 2006:72.

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The research work was carried out as an initiative.

It is executed at the department of general hygiene, scientific leader - professor

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