*Огляди літератури, **оригінальні дослідження**, погляд на проблему, випадок з практики, короткі повідомлення*
УДК 613.31:546.32/.33-06:616.155.3]-092.9
DOI 10.11603/1811-2471.2019.v0.i2.10366

INFLUENCE OF LEAD ACETATE IN CONJUNCTION WITH STEARATES ON THE BONE BRAIN AND PERIPHERAL BLOOD OF SUSPICIOUS ANIMALS

©O. E. Fedoriv, O. E. Kopach, N. A. Melnyk

I. Horbachevsky Ternopil National Medical University

SUMMARY. In modern conditions, industrial pollution of the environment with lead is quite significant and has an adverse effect on the body. It has pronounced cumulative properties and is accumulated in bones in the form of insoluble tri-phosphorus. However, under the influence of certain conditions, its reserves in the bones become mobile; it transits into the bloodstream and can cause poisoning, even in the sharp form.

The aim – to study the effect of lead acetate in the body at sub-toxic doses on the background of drinking water with stearates content.

Materials and Methods. To study the influence of low-frequency lead in isolation and in combination with stearates under conditions of a subacute sanitary-toxicological experiment, the animals were divided into four groups of 7 animals each. The group 1 of animals was a control group. The group 2 of animals consumed dechlorinated water from the city water supply (water + AcPb). Animals of the groups 3 and 4 also consumed dechlorinated water from the city water supply, but with an admixture of sodium stearate (group 3 StNa + AcPb) and potassium stearate (group 4 StK + AcPb) at a dose of 1/250 LD50. After a 30-day application of these waters to animals, the groups 2, 3 and 4 were orally administered lead acetate at a dose of 7 mg/100 g of body weight (1/110 LD_{50}).

Results and Discussion. As a result of the action of lead acetate in a dose of 70 mg/kg and stearates, there was an increase in the bone marrow of the number of promyelocytes, stem cells, segmental neutrophils of lymphocytes and normocytes. However, the number of myelocytes and metamyelocytes decreased. Lead acetate and stearates caused an increase in the number of rodenuclear neutrophils, eosinophils, monocytes, lymphocytes and a decrease in the number of segmental neutrophils in the blood of experimental animals. Unlike intact animals in the groups 2, 3 and 4, there were observed events of functional failure of the erythrocytes system such as anisocytosis, poikilocytosis and hypochromia.

Conclusions. 1. Thus, with the action of lead acetate at a dose of 70 mg/kg in combination with sodium and potassium stearates, there was an increase in the bone marrow of promyelocytes, stabnoid, segmented neutrophils of lymphocytes and normocytes. The number of myelocytes and metamyelocytes decreased.

2. Lead acetate in combination with sodium and potassium stearates caused an increase in the number of stab neutrophils, eosinophils, monocytes, lymphocytes and a decrease in the number of segmented neutrophils in the blood of experimental animals.

KEY WORDS: water; lead acetate; sodium stearate; potassium stearate; peripheral blood; bone marrow.

Introduction. In modern conditions, technogenic pollution of the environment with lead is quite significant and has an adverse effect on the body. It pronounced cumulative properties and accumulates in the bones in the form of insoluble three basic phosphates. However, under the influence of certain conditions, its reserves in the bones become mobile it passes into the blood and can cause poisoning even in an acute form. The factors that contribute to its mobilization include high acidity, calcium deficiency in food, alcohol abuse [1–9]. Lead compounds also activate lipid peroxidation [10–12], inhibit the antioxidant defense system, reducing the concentration of glutathione in blood and tissues and inhibiting the activity of antioxidant enzymes [13]. A potent source of lead into the human body is drinking water, which, as a rule, causes an increase in its concentration in the blood.

In modern conditions, in various sources of water, household, drinking and cultural-household water uses in significant quantities are surfactants, which include sodium and potassium stearates. Knowing their negative effect on the liver function, kidney function, metabolic processes in the experimental animals [14–16], it was interesting to study the effect of lead acetate in the body at sub-toxic doses on the background of drinking water with stearate content.

Materials and Methods. To study the effect of lead acetate in isolation, as well as in combination with sodium stearate and potassium stearate under the conditions of an acute experiment, non-linear white female rats with a body weight of 160–200 grams were used. Care of animals and all manipulations were carried out in accordance with the provision of "European convection on the protection of vertebrates used for experimental and other scientific purposes" (Strasbourg, 1986), as well as the "Common ethical principles of animal experiments" adopted b"Rules for conducting work using experimental animals approved by the order of the Ministry of Health No. 755 of August 12, 1977 "On measures for further improvement of organizational forms of work with the use of experimental animals". The Bioethics Commission of the State Higher Edu-

cational Institution "I. Horbachevsky Ternopil State Medical University" (Minutes No. 25 of 7 October 2014) did not reveal violations of the moral and ethical standards when conducting research work on experimental animals.

The experiments were carried out on four groups of white female rats weighing 150–200 g, 7 animals per group. Animals were on a common diet of the vivarium in the same conditions and differed only in the quality of drinking water. Water was taken from the Ternopil Urban Water Pipeline, which is fed from an alluvial horizon located at a depth of 28–32 m. The chemical composition of water is of the hydrocarbonate-calcium class and meets the requirements of the State Sanitary and Epidemiological Service of Ukraine № 2.2.4–171-10 "Hygienic requirements for drinking water intended for human consumption" [17]. The water was dechlorinated and enriched with sodium and potassium stearates.

To study the influence of low-frequency lead in isolation and in combination with stearates under conditions of a subacute sanitary-toxicological experiment, the animals were divided into four groups of 7 animals each. The group 1 of animals was a control group. The group 2 of animals consumed dechlorinated water from the city water supply (water + AcPb). Animals of the groups 3 and 4 also consumed dechlorinated water from the city water supply, but with an admixture of sodium stearate (group 3 StNa + AcPb) and potassium stearate (4 groupStK + AcPb) at a dose of 1/250 LD_{50}. After a 30-day application of these waters to animals, the groups 2, 3 and 4 were orally administered lead acetate at a dose of 7 mg/100 g of body weight (1/110 LD_{50}). Lead acetate was produced by Reaktiv LLC (Donetsk, Ukraine). Product specifications: lead (II) acetic acid 3-water, h, Pb $(CH_3COO)_2 \times 3H_2O$. The molar mass is 379.33. Net – 0.02 kg ± 5 % of "State Standard 1027".

To study the bone marrow, puncture of the sternum was performed punctures made from the punctate for cytological examination.

When studying the bone marrow, the absolute content of myelokaryocytes, megakaryocytes, was determined the percentage of bone marrow elements was counted. For the evaluation of myelogram, it is important not so much to determine the number of bone marrow elements and their percentage as their mutual relationship. It is necessary to judge the composition of myelogram by specially calculated bone marrow indices, which determine these relationships [18].

The content of leukocytes was determined by counting nucleus-containing cells in 100 squares of Goryaev's chamber.

Results and Discussion. Lead refers to dangerous pollutants of the environment, which negatively affect the body and the functioning of its organs and systems: the heart, liver, kidneys, nervous system, and blood. Therefore, our task was to study the effect of lead acetate in combination with sodium and potassium stearates on the bone marrow of animals and their peripheral blood.

The study of the effect of lead acetate in combination with stearates on the bone marrow of animals

In the combined action of sodium and potassium stearate and lead acetate, changes of a different nature in the bone marrow of animals were observed in comparison with intact animals (Fig. 1). In control animals and group 3, who consumed water from sodium stearate followed by the administration of lead acetate, the amount of promyelocyte in the bone marrow myelogram was the same (1.29±0.18) %.

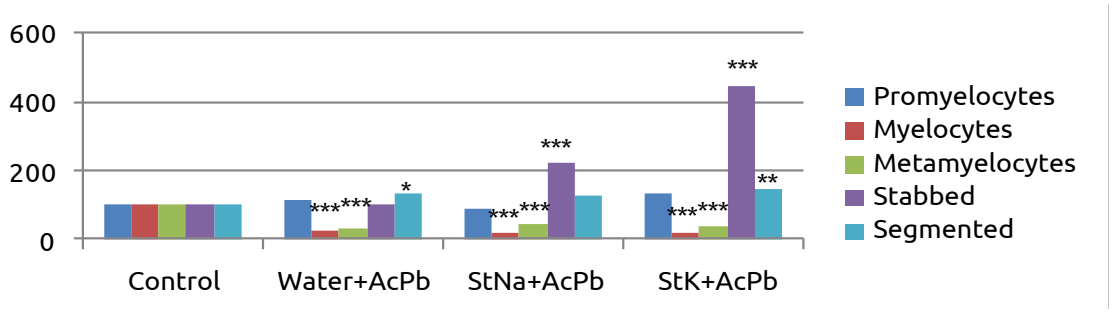

Fig. 1. The number of promyelocytes, myelocytes, metamyelocytes, stabnuclear and segmented neutrophils in the bone marrow myelogram of white rats with drinking water and water containing sodium and potassium stearate in combination with lead acetate (in % of total).

In animals of the group 2, who took ordinary drinking water and also obtained lead acetate, the amount of promyelocyte was 1.3 times greater than in intact animals (p>0.05) ((1.71±0.18) % vs. (1.29± 0.18) %). In group 4 of animals that consumed water from potassium stearate followed by lead acetate,

the number of these cells was 1.6 times less than in the control group and group 3 ((2.00±0.22)) % against, (29±0.18) %) (p<0.05). In animals of the group 2, the amount of promyelocyte was 1.2 times less than in animals of the group 4 (1.71±0.18)% vs. (2.00±0.22) %).

With the action of sodium and potassium stearates in combination with lead acetate, the amount of myelocytes was less than in intact animals. Thus, in the animals of the groups 2, 3 and 4, the number of myelocytes in the bone marrow myelogram was 2.2, 5.3 and 5.7 times less, respectively, as compared with intact animals ((2.14±0.26) %, (1.86±0.26) % and (1.71±0.29) % against (9.86±0.51) %) (p<0.001). There was also a smaller number of myelocytes in the animals of groups 3 and 4 taking water from sodium and potassium stearates, respectively, compared to the animals of the second group who consumed ordinary drinking water: 1.2 and 1.3 times, respectively.

With the combined action of sodium and potassium steroids and lead acetate, the amount of metamyelocytes was also lower compared to intact animals. Thus, in the animals of the groups 2, 3, and 4, the number of metamyelocytes in the bone marrow myelogram was 3.5, 2.3 and 3.0 times less, respectively, compared to intact animals ((1.29±0.18) %, (2.00±0.38) % and (1.57±0.20) % against (4.57±0.20) %), which is statistically significant (p<0.001). However, a slightly larger number of metamyelocytes was observed in animals of the groups 3 and 4 taking water from sodium and potassium stearates, respectively, compared to the animals of the group 2 who consumed ordinary drinking water: 1.6 and 1.2 times as thick as, respectively ((2.00±0.38) % and (1.57±0.20) % against (1.29±0.18) %). In animals of the group 3, who took water from sodium stearate, the amount of metamyelocytes was 1.3 times greater than in the animals of the group 4 who consumed water with potassium stearate.

With the combined action of sodium and potassium steroids and lead acetate, the number of stab neutrophils was also greater in comparison with intact animals. In the animals of the groups 3 and 4, the number of stab neutrophils in the bone marrow myelogram was 2.3 and 4.6 times higher, respectively, compared with intact animals ((9.00±0.98) %, and (17.86±1.87) % vs. (3.86±0.40) %) (p <0.001). In the animals of the group 2, the number of stab neutrophils was the same as in the control group of animals. In animals of the groups 3 and 4, taking water from sodium and potassium stearate, respectively, followed by the introduction of lead acetate, the number of these cells in the bone marrow was 2.3 and 4.5 times greater than in animals of the group 2 that consumed water without stearates ((9.00±0.98) %, and (17.86±1.87) % against (4.00±0.58 %). In the group 4 animals, the number of stab neutrophils was almost 2.0 times higher than in animals of the group 3, ((17.86±1.87) % vs. (9.00±0.98) %).

In experimental animals, there was a slight increase in the number of segmented neutrophils in the bone marrow of white rats compared with the control group. Thus, in the animals of the groups 2, 3 and 4, the number of segmented neutrophils in the myelogram was 1.4 (p<0.01), respectively, and 1.3 and 1.4 (p<0.05), respectively, than in intact animals: (17.71±1.23) %, (16.29±1.52) % and (18.71±1.80) % vs. (13.00±0.58) %. In the animals of the group 3, who consumed water from sodium stearate and followed by oral administration of a sub-toxic dose of lead acetate, the number of segmented neutrophils was slightly less than in the animals in the group 2 that they used ordinary drinking water (p> 0.05), in animals of the group 4, the number of these cells in the bone marrow of animals was somewhat larger than in the animals of the group 2 (p> 0.05).

The number of eosinophils in animals of the group 4 was 2.5 times larger (p<0.05) than in intact animals (1.57±0.20) % and amounted to (3.86±0.74) % (Fig. 2).

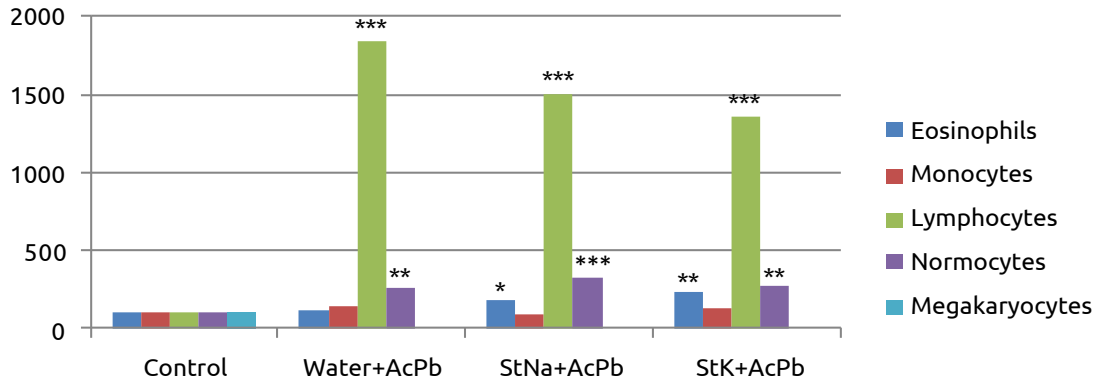

Fig. 2. The number of eosinophils, monocytes, lymphocytes, normocytes and megakaryocytes in the myelogram of the bone marrow of white rats with drinking water and water containing sodium and potassium stearate in combination with lead acetate (in % of the total)

In the animals of the third group that consumed water from sodium stearate, the number of eosinophils was 1.9 times greater (p <0.01) ((2.86±0.26) % vs. (1.57±0.20) %). In the animals of the group 2 who consumed ordinary drinking water from the city water supply, the number of eosinophils was almost the same as in the animals in the control group. In the animals of the groups 3 and 4, the number of eosinophils was 1.5 and 2.1 (p<0.05), respectively, more than in animals of the group 2 who consumed water without stearates. It is also worth noting that in the animals of the group 3 that water was consumed from sodium stearate and followed by oral administration of lead acetate, the number of eosinophils was 1.3 times less than in the group 4 animals taking water with potassium stearate and lead acetate was also obtained ((2.86±0.26) % vs. (3.86±0.74) %).

With the combined effect of sodium and potassium stearate and lead acetate stearate, the monocyte count in experimental animals was different in comparison with intact animals. In white rats of the group 2, who took the usual drinking water followed by oral administration of lead acetate, the amount of monocytes in the bone marrow was 1.3 times greater than in the control, which is not statistically significant ((2.00±0.22) % against (1.57±0.20) %). In the animals of the group 3, the number of these cells was 1.2 times less than in intact animals ((1.29± 0.18) % vs. (1.57±0.20) %), and in animals of the group 4, the number of monocytes was 1.1 times higher than in the control group (1.71±0.18) % vs. (1.57±0.20) %) (p<0.05). There were also a slightly smaller number of monocytes in the animals of the groups 3 and 4 taking water with sterols in combination with lead acetate compared to animals of the group 2 who consumed ordinary drinking water without stearates (p< 0.05).

With the combined action of stearates and lead acetate, a significant increase in the number of lymphocytes in experimental animals was observed in comparison with intact animals (Fig. 2). As can be seen from this figure, in the experimental animals of the groups 2, 3 and 4, the number of lymphocytes in the bone marrow was respectively 17.7, 14.4 and 13.0 times greater than in the intact animals ((50.71±3.22) %, (41.14±2.16) % and (37.29±2.63) % versus (2.86±0.59) %), (p<0.001). Also, a larger number of lymphocytes were observed in animals of the group 2 who consumed ordinary water without stearates compared to animals of the 3rd and 4th groups who consumed water from stearates: 1.2 and 1.4 times, respectively (p<0.05).

A statistically significant (p<0.001) increase in the number of normocytes was observed in the experimental animals of the groups 2, 3 and 4, than in intact animals: 2.6, 3.3 and 2.9 times, respectively: (14.00±1.09) %, (17.71±0.64) % and (15.29±1.58) % against (5.29±0.47) %. In animals of the groups 3 and 4, the number of normocytes in the bone marrow myelogram was 3.3 (p<0.05) and 1.1 times, respectively, than in animals of the group 2. Megakaryocytes in the bone marrow of experimental animals were not observed, in contrast to intact animals.

The study the effect of lead acetate in combination with stearates on the state of peripheral blood of animals

With the combined action of sodium and potassium stearates and lead acetate, an increase in the number of different types of blood leukocytes of animals occurred in comparison with intact animals (Fig. 3).

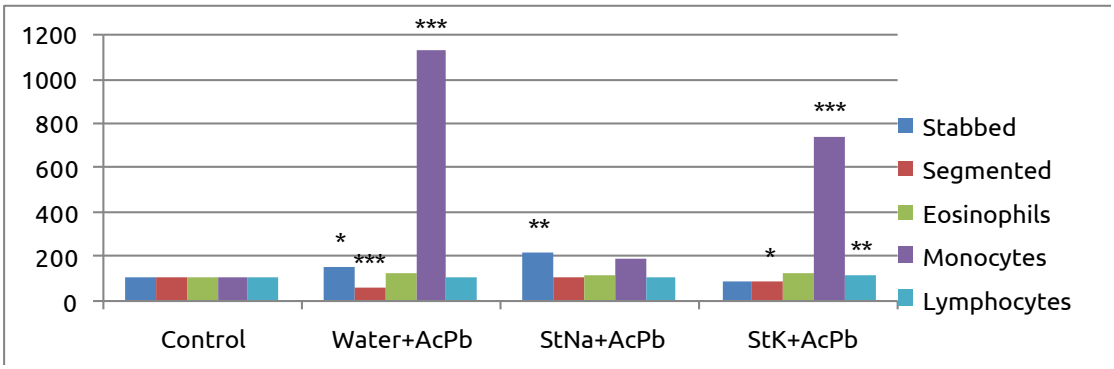

Fig. 3. The number of stab neutrophils, segmented neutrophils, eosinophils, monocytes and lymphocytes in the peripheral blood of white rats with drinking water and water containing sodium and potassium stearate in combination with lead acetate (in% of the total).

In the animals of the group 3, the number of stab neutrophils was 2.3 times greater in comparison with the animals in the control group: (5.86±0.77) % vs. (2.57±0.30) % (p<0.01), and 1.4 times more than in animals of the group 2: (5.86±0.77) % vs. (4.14±0.46) %. In the group 4 of animals taking water with potassium stearate, the number of stab neutrophils in peripheral blood was 2.6 times less than in animals of the

group 3 ((2.29±0.18) % vs. (5.86±0.77) %) and 1.8 times less than the group 2 (p <0.01): (2.29±0.18) % vs. (4.14±0.46) %.

The number of segmented neutrophils in the peripheral blood of white rats had a slightly different character than the number of stab neutrophils. In the peripheral blood of the group 2 of white rats taking water without stearates in combination with lead acetate, the lymphocyte count was 1.7 times less than in the control animals (p<0.001): (7.86±0.55) % against (13.00±0.65) %. In the group 4 of animals taking water with potassium stearate, lead acetate was obtained, the amount of lymphocytes was 1.2 times lower ((11.00 ± 0.31) % vs. (13.00 ± 0.65) %.) than in intact animals (p<0.05), however, it was 1.4 times greater than in animals of the group 2 (p<0.001): (11.00±0.31) % vs. (7.86±0.55) %. In the animals of the group 3, the number of lymphocytes was the same as in the animals of the control group, while at the same time it was 1.7 times greater than in the animals of the group 2 taking the usual drinking water (p<0.001).

The results of the studies showed that the amount of eosinophils in the peripheral blood of white rats with the combined action of lead stearates and acetate is also different. In animals of the groups 2 and 4, the number of eosinophils in the peripheral blood was the same, but was 1.2 times higher than in the control group ((2.14±0.14) % vs. (1.86±0.26) %) and in the group 3 of animals. There is a difference between animals that consumed water from sodium and potassium stearates (groups 3 and 4): in animals of the group 3, the number of eosinophils in peripheral blood was 1.2 times less than in the group 4 ((1.86±0.14) % vs. (2.14±0.26) %).

The number of monocytes in the peripheral blood of white rats with the combined action of sodium and potassium stearate and lead acetate has a slightly different character. As the results of the research showed, sodium and potassium stearate in combination with oral administration of lead acetate promoted an increase in the number of monocytes in the peripheral blood of animals. In particular, in animals of the group 2 who took ordinary drinking water and obtained lead acetate, the amount of monocytes was 10.5 times greater than in the control group of animals (p <0.001): (13.57±1.85) % vs. (1.29±0.18) %. In the animals of the group 3, who consumed water from sodium stearate, the number of monocytes was 1.8 times greater in comparison with intact animals (p<0.05) ((2.29±0.36) % against (1.29±0.18) %), in animals of the group 4, who took water from potassium stearate – 6.9 times more (p <0.001) ((8.86±0.63) % vs. (1.29±0.18) %). In animals of the groups 3 and 4, the number of monocytes in the peripheral blood was 5.9 (p<0.001) and 1.5 (p<0.05) times, respectively, than in animals of the group 2, respectively. In the animals of the group 4 that consumed water from potassium stearate, the number of monocytes was 3.9 times higher than in the group 3 of animals that consumed water from sodium stearate ((8.86±0.63) % vs. (29±0.36) %).

The number of lymphocytes in the peripheral blood of white rats was similar in nature. In particular, in animals of the group 2, who took ordinary drinking water and obtained lead acetate, the lymphocyte count was 1.1 times greater than in the control group of animals ((75.14±2.68) % vs. (70.57±0.53) %). In the animals of the group 3 that consumed water from sodium stearate, the amount of lymphocytes was almost the same as in intact animals, in rats of the group 4, who took water from potassium stearate, was 1.1 times greater (p <0.01) ((80.71±2.97) % vs. (70.57± 0.53) %). In the group 4, the number of lymphocytes in the peripheral blood was 1.1 times greater than in the animals of the group 2. In the animals of the group 4 that consumed water from potassium stearate, the number of lymphocytes was 1.2 times greater than in the group 3 of animals that consumed water from sodium stearate ((80.71±2.97) % against (71.71±1.13) %).

Conclusions. 1. Thus, with the action of lead acetate at a dose of 70 mg/kg in combination with sodium and potassium stearates, there was an increase in the bone marrow of promyelocytes, stabnoid, segmented neutrophils of lymphocytes and normocytes. The number of myelocytes and metamyelocytes decreased.

2. Lead acetate in combination with sodium and potassium stearates caused an increase in the number of stab neutrophils, eosinophils, monocytes, lymphocytes and a decrease in the number of segmented neutrophils in the blood of experimental animals. Unlike intact animals of the groups 2, 3 and 4, phenomena of functional insufficiency of the erythrocyte system were observed, such as anisocytosis, poikilocytosis and hypochromia.

Prospects of further researches. The data established by us testify to the need for a more detailed study of the combined effect on the body of warm-blooded animals of toxic and non-toxic substances in different environments.

LITERATURE

1. Агапова В. Т. Оцінка ризиків для здоров'я населення внаслідок емісії свинцю від антропогенних джерел / В. Т. Агапова, О. В. Золотько // Збірка тез XIII Міжнародної науково-практичної конференції студентів, аспірантів та молодих вчених «Екологія. Людина. Суспільство» – 2012. – № 3. – С. 29–34.

2. Проблемні питання нанотоксикології / М. Г. Проданчук, Л. І. Власик, С. Є. Дейнека, М. М. Тураш // Сучасні пролеми токсикології. – № 5. – 2011. – С. 40–41.

3. Дослідження впливу мікро- і наночастинок свинцю на білки системи згортання крові в умовах in vitro / І. В. Губар, О. С. Ільчук, С.І. Куповська, К. П. Осипенко // Таврический медико-биологический вестник. – 2012. – Т. 15, № 1 (57). – С. 307–309.

4. Effect of chronic lead intoxication on formed elements morphology and some biochemical parameters of blood plasma of white rats / O. S. Shubina, N. A. Melnikova, O. V. Liferenko, V. S. Bardin // 3rd International Conference on Science and Technology, London, 17–18 June 2013. – London: SCIEURO, 2013. – P. 323–333.

5. Dydenkova N. Morphological and functional changes in somniferous epithelium of the testes of white rats under the effect of lead acetate / N. Dydenkova, O. Shybina // DOAJ – Lund University : Koncept: Scientific and Methodological e-magazine. – Lund, Sweden, 2013. – Vol. 1, No. 2. – P. 291–295.

6. Shubina O. S. Morphological changes in the structure of ovarian white rats under the influence of lead acetate / O. S. Shubina, N. A. Dudenkova // 3rd International Conference on Science and Technology, London, 17–18 June 2013. – London : SCIEURO, 2013. – P. 313–322.

7. Федорив О. Е. Действие наночастиц свинца на фоне употребления питьевой воды с содержанием стеаратов натрия и калия на организм экспериментальных животных / О. Е. Федорив, В. А. Кондратюк, Е. В. Лотоцкая // Здоровье и окружающая среда : сборник научных трудов. – 2013. – Вып. 22. — С. 63–66.

8. Дашковський О. О. Механізми токсичної дії свинцю на кровотворну систему і процеси обміну речовин в організмі корів / О. О. Дашковський, М. В. Фоміна, Б. М. Калин // Науковий вісник ЛНУВМБТ імені С. З. Гжицького. – 2013. – № 1 (55), Частина 4. – С. 46–51.

9. Романенко О. А. Дослідження впливу ацетату свинцю на розвиток печінки та формування судинного русла ембріонів щурів / О. А. Романенко // Таврический медико-биологический вестник. – 2010. – Т. 13, № 4 (52).– С. 160–163.

10. Hannah W. Nanotechnology, risk and the environment: a review / W. Hannah, P. B. Thompson // J. Environ. Monit. – 2008. – Vol. 10, No. 3. – P. 291–300.

11. Pro-inflammogenic effects of low-toxicity and metal nanoparticles in vivo and in vitro: highlighting the role of particle surface area and surface reactivity / R. Duffin, L. Tran, D. Brown [et al.] // Inhal. Toxicol. – 2007. – P. 849–856.

12. Lewinski N. Cytotoxicity of nanoparticles / N. Lewinski, V. Colvin, R. Drezek // Small. – 2008. – Vol. 4 (1). – P. 26–49.

13. Analytical methods to assess nanoparticle toxicity / B. J. Marquis, S. A. Love, K. L. Braun, C. L. Haynes // Analyst. – 2009. – Vol. 134 (3). – P. 425–439.

14. Щербань Н. Г. Особенности нарушения микроэлементного обмена у экспериментальных животных под воздействием поверхностно-активных веществ / Н. Г. Щербань // Вісник НТУ ХПІ. – 2012. – № 50 (956). – С. 83–87.

15. Щербань Н. Г. Методические аспекты использования методологии оценки риска здоровью населения при воздействии факторов окружающей среды в Украине и России / Н. Г. Щербань, В. В. Мясоедов, Е. А. Шевченко // II Вісник Харківського національного університету імені В. Н. Каразіна; серія: Медицина. – 2010. – № 898, Вип. 19. – С. 97–103.

16. Лотоцька О. В. Вплив стеарату натрію на органолептичні властивості води / О. В. Лотоцька // Гігієна населених місць. – 2011. – № 57. – С. 97–101.

17. ГосСанПиН Украины № 2.2.4-171-10 «Гигиенические требования к воде питьевой, предназначенной для потребления человеком».

18. Сапожников А. Г. Гистологическая и микроскопическая техника : руководство / А. Г. Сапожников, А. Е. Доросевич. – Смоленск : САУ, 2000. – 476 с.

REFERENCES

1. Ahapova, V.T. (2012). Otsinka ryzykiv dlia zdorovia naselennia vnaslidok emisii svyntsiu vid antropohennykh dzherel [Assessment of the health risks of the population as a result of the emission of lead from anthropogenic sources] *Zbirka tez XIII Mizhnarodnoi naukovo-praktychnoi konferentsii studentiv, aspirantiv ta molodykh vchenykh "Ekolohiia. Liudyna. Suspilstvo" – Collection of theses of the XIII International scientific and practical conference of students, postgraduates and young scientists "Ecology. Man. Society",* 3, 29-34 [in Ukrainian].

2. Prodanchuk, M.H., Vlasyk, L.I., Deineka, S.Ie., & Turash, M.M. (2011). Problemni pytannia nanotoksykolohii [Problematic issues of nanotoxicology]. *Suchasni problemy toksykolohii – Modern Prolems of Toxicology,* 5, 40-41 [in Ukrainian].

3. Hubar, I.V. Ilchuk, O.S., Kupovska, S.I., & Osypenko, K.P. (2012). Doslidzhennia vplyvu mikro- i nanochastynok svyntsiu na bilky systemy zhortannia krovi v umovakh in vitro [Investigation of the influence of lead and nanoparticles on proteins of the system of blood clotting under in vitro conditions]. *Tavrycheskyi medyko-biologicheskyy vestnyk – Tauride Medical and Biological Herald,* 1 (57), 307-309 [in Ukrainian].

4. Shubina, O.S., Melnikova, O.V., & Liferenko, V.S. (2013). Effect of chronic lead intoxication on formed elements morphology and some biochemical parameters

of blood plasma of white rats. *3rd International Conference on Science and Technology*, London, 17-18 June SCIEURO, 323-333.

5. Dydenkova, N., & Shybina, O. (2013). Morphological and functional changes in somniferous epithelium of the testes of white rats under the effect of lead acetate *DOAJ – Lund University: Koncept: Scientific and Methodological e-magazine*, Lund, Sweden, 1 (2), 291-295.

6. Shubina, O.S., & Dudenkova, N.A. (2013). Morphological changes in the structure of ovarian white rats under the influence of lead acetate. *3rd International Conference on Science and Technology*, London, 17-18 June 2013, 313-322.

7. Fedoriv, O.E., Kondratiuk, V.A., & Lototskaya, E.V. (2013). Deystvye nanochastits svintsa na fone upotrebleniya pytevoy vody s soderzhanyem stearatov natriya i kaliya na organizm eksperymentalnykh zhyvotnykh [The effect of lead nanoparticles against the use of drinking water containing sodium and potassium stearates on the organism of experimental animals]. *Zdorovye i okruzhayushchaya sreda. Sbornik nauchnykh trudov – Health and Environment. Collection of Scientific Papers* (pp. 63-66). Minsk [in Russian].

8. Dashkovskyi, O.O., Fomina, M.V., & Kalyn, B.M. (2013). Mekhanizmy toksychnoi dii svyntsiu na krovotvornu systemu i protsesy obminu rechovyn v orhanizmi koriv [Mechanisms of toxic action of lead on the hematopoietic system and metabolic processes in the body of cows]. *Naukovyi visnyk LNUVMBT imeni S.Z. Hzhytskohoho – Scientific Herald of LNUWMBT named after S.Z. Hzhytskyi* (Part 4) 15-1 (55), 46-51 [in Ukrainian].

9. Romanenko, O.A., (2010). Doslidzhennia vplyvu atsetatu svyntsiu na rozvytok pechinky ta formuvannia sudynnoho rusla embrioniv shchuriv [Investigation of the effect of lead acetate on the development of the liver and the formation of the vascular bed of embryos in rats]. *Tavricheskyy medyko-biologicheskyy vestnyk – Tauride Medical and Biological Herald,* 13, 4 (52), 160-163 [in Ukrainian].

10. Hannah, W., & Thompson, P.B. (2008). Nanotechnology, risk and the environment: a review *J. Environ. Monit.,* 10, (3), 291-300.

11. Duffin, R., Tran, L, Brown, D., Stone V., & Donaldson, K. (2007). Pro-inflammogenic effects of low-toxicity and metal nanoparticles in vivo and in vitro: highlighting the role of particle surface area and surface reactivity. *Inhal. Toxicol.*, 849-856.

12. Lewinski, N., Colvin, V., & Drezek, R. (2008). Cytotoxicity of nanoparticles. *Small.*, 4 (1), 26-49.

13. Marquis, B.J. Love, S.A., Braun, K.L., & Haynes, C.L. (2009). Analytical methods to assess nanoparticle toxicity. *Analyst.*, 134 (3), 425-439.

14. Shcherban, N.H. (2012). Osobennosti narusheniya mikroelementnogo obmena u eksperymentalnykh zhyvotnykh pod vozdeystvyem poverkhnostno-aktivnykh veshchestv [Features of violation of trace element in experimental animals under the influence of surfactants]. *Visnyk NTU – Herald of NTU, ХПІ,* 50(956), 83-87 [in Russian].

15. Shcherban, N.H. Myasoedov, V.V., & Shevchenko, E.A. (2010). Metodicheskye aspekty ispolzovaniya metodologii otsenky riska zdorovyu naseleniya pri vozdeystvii faktorov okruzhayushchey sredy v Ukraine i Rossii [Methodological aspects of using the methodology for assessing the risk to public health when exposed to environmental factors in Ukraine and Russia]. *II Visnyk Kharkivskoho natsionalnoho universytetu im. V.N. Karazina – II Bulletin of V.N. Karazin Kharkiv National University.* (898 series: Medicine), 19, 97-103 [in Russian].

16. Lototska, O.V. (2011). Vplyv stearatu natriiu na orhanoleptychni vlastyvosti vody [Influence of sodium stearate on the organoleptic properties of water]. *Hihiiena naselenykh mists – Hygiene of Populated Places*, 57, 97-101 [in Ukrainian].

17. GosSanPiN Ukrainy № 2.2.4-171-10 "Gigiyenicheskie trebovaniya k vode pitevoy, prednaznachennoy dlya potrebleniya chelovekom" [State Sanitary Rules and Norms of Ukraine No. 2.2.4-171-10 "Hygienic requirements for drinking water intended for human consumption"] [in Russian].

18. Sapozhnikov, A.G., & Dorosevich, A.E. (2000). *Gistologicheskaya i mikroskopicheskaya tehnika: rukovodstv [Histological and microscopic technique: a guide].* Smolensk: SAU [in Russian].

ВПЛИВ НАНОЧАСТИНОК СВИНЦЮ В ПОЄДНАННІ ЗІ СТЕАРАТАМИ НА КІСТКОВИЙ МОЗОК І ПЕРИФЕРІЙНУ КРОВ ПІДДОСЛІДНИХ ТВАРИН

©О. Є. Федорів, О. Є. Копач, Н. А. Мельник

Тернопільський національний медичний університет імені І. Я. Горбачевського МОЗ України

РЕЗЮМЕ. В сучасних умовах техногенне забруднення довкілля свинцем досить значне і чинить несприятливу дію на організм. Свинець має виражені кумулятивні властивості і накопичується в кістках у вигляді нерозчинних триосновних фосфатів. Проте під впливом певних умов запаси його в кістках стають мобільними, він переходить у кров і може викликати отруєння навіть у загостреній формі.

Мета – вивчити вплив ацетату свинцю в субтоксичних дозах на фоні питної води зі змістом стеаратів на організм.

Матеріал і методи. Для вивчення впливу ацетату свинцю в ізоляції та в поєднанні зі стеаратами в умовах підгострого санітарно-токсикологічного експерименту тварини були розділені на чотири групи по 7 тварин у кожній. Перша група тварин була контрольною групою. Друга група тварин споживала дехлоровану воду з міського водопостачання (вода + AcPb). Тварини третьої та четвертої груп також споживали дехлоровану воду з міського водопостачання, але з домішкою стеарату натрію (група 3 StNa + AcPb) і стеарату калію (4 groupStK +

AcPb) у дозі 1/250 LD_{50}. Після 30-денного застосування цих вод тваринам 2-ої, 3-ої і 4-ої груп перорально вводили ацетат свинцю в дозі 7 мг / 100 г маси тіла (1/110 $ЛД_{50}$).

Результати. В результаті дії ацетату свинцю в дозі 70 мг/кг і стеаратів відбулося збільшення кількості кісткового мозку з числа промієлоцитів, сегментарних нейтрофілів лімфоцитів і нормоцитів. Однак кількість мієлоцитів і метаміелоцитів зменшилося. Ацетат свинцю і стеарати викликали збільшення кількості нейтрофілів, еозинофілів, моноцитів, лімфоцитів і зменшення кількості сегментоядерних нейтрофілів у крові експериментальних тварин. На відміну від інтактних тварин, у 2-й, 3-й і 4-й групах спостерігалися явища функціональної недостатності системи еритроцитів, такі як анізоцитоз, пойкілоцитоз і гіпохромія.

Висновки. Таким чином, при дії ацетату свинцю в дозі 70 мг/кг в комбінації із стеаратами натрію і калію відбувалося збільшення у кістковому мозку кількості промієлоцитів, паличкоядерних, сегментоядерних нейтрофілів лімфоцитів та нормоцитів. Зменшувалась кількість мієлоцитів і метамієлоцитів. Ацетат свинцю в комбінації із стеаратами натрію і калію викликав збільшення кількості паличкоядерних нейтрофілів, еозинофілів, моноцитів, лімфоцитів та зменшення кількості сегментоядерних нейтрофілів в крові піддослідних тварин. На відміну від інтактних тварин, у тварин 2-ї, 3-ї та 4-ї груп спостерігалися явища функціональної недостатності системи еритроцитів, такі як анізоцитоз, пойкілоцитоз та гіпохромія.

КЛЮЧОВІ СЛОВА: вода, ацетат свинцю, стеарат натрію, стеарат калію, периферична кров, кістковий мозок.

ВЛИЯНИЕ НАНОЧАСТИЦ СВИНЦА В СОЧЕТАНИИ СО СТЕАРАТАМИ НА КОСТНЫЙ МОЗГ И ПЕРИФЕРИЧЕСКУЮ КРОВЬ ПОДОПЫТНЫХ ЖИВОТНЫХ

©О. Е. Федорив, О. Е. Копач, Н. А. Мельник

Тернопольский национальный медицинский университет имени И. Я. Горбачевского МОЗ Украины

РЕЗЮМЕ. В современных условиях техногенное загрязнение окружающей среды свинцом довольно значительное и оказывает неблагоприятное воздействие на организм. Он обладает выраженными кумулятивными свойствами и накапливается в костях в виде нерастворимых трех основных фосфатов. Однако под влиянием определенных условий запасы его в костях становятся мобильными, он переходит в кровь и может вызвать отравление даже в обостренной форме.

Цель – изучить влияние ацетата свинца в субтоксических дозах на фоне питьевой воды с содержанием стеаратов на организм.

Материал и методы. Для изучения влияния ацетата свинца в изоляции и в сочетании со стеаратами в условиях подострого санитарно-токсикологического эксперимента животные были поделены на четыре группы по 7 животных в каждой. Первая группа животных была контрольной. Вторая группа животных употребляла дехлорированную воду из городского водоснабжения (вода + AcPb). Животные третьей и четвертой групп также употребляли дехлорированную воду из городского водоснабжения, но с примесью стеарата натрия (группа 3 StNa + AcPb) и стеарата калия (4 groupStK + AcPb) в дозе 1/250 LD_{50}. После 30-дневного применения этих вод животным второй, третьей и четвёртой групп перорально вводили ацетат свинца в дозе 7 мг/100 г массы тела (1/110 $ЛД_{50}$).

Результаты. В результате действия ацетата свинца в дозе 70 мг/кг и стеаратов произошло увеличение количества клеток костного мозга из числа промиелоцитов, сегментарных нейтрофилов, лимфоцитов и нормоцитов. Однако количество миелоцитов и метамиелоцитов уменьшилось. Ацетат свинца и стеараты вызвали увеличение количества нейтрофилов, эозинофилов, моноцитов, лимфоцитов и уменьшение количества сегментарных нейтрофилов в крови экспериментальных животных. В отличие от интактных животных, во 2-й, 3-й и 4-й группах наблюдались явления функциональной недостаточности системы эритроцитов, такие как анизоцитоз, пойкилоцитоз и гипохромия.

Выводы. Таким образом, при действии ацетата свинца в дозе 70 мг/кг в комбинации со стеаратами натрия и калия происходило увеличение в костном мозге количества промиелоцитив, палочкоядерных, сегментоядерных нейтрофилов, лимфоцитов и нормоцитов. Уменьшалось количество миелоцитов и метамиелоцитов. Ацетат свинца в сочетании со стеаратами натрия и калия вызвал увеличение количества палочкоядерных нейтрофилов, эозинофилов, моноцитов, лимфоцитов и уменьшение количества сегментоядерных нейтрофилов в крови подопытных животных. В отличие от интактных животных, у животных 2-й, 3-й и 4-й групп наблюдались явления функциональной недостаточности системы эритроцитов, такие как анизоцитоз, пойкилоцитоз и гипохромия.

КЛЮЧЕВЫЕ СЛОВА: вода; ацетат свинца; стеарат натрия; стеарат калия; периферическая кровь; костный мозг.

Received 9.04.2019