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**CORRECTION OF RED BLOOD INDICATORS WITH CONTINUOUS
COMBINED EFFECT OF LOW INTENSITY IONIZING RADIATION
КОРЕКЦІЯ ПОКАЗНИКІВ ЧЕРВОНОЇ КРОВІ ПРИ ПОСТІЙНІЙ КОМБІНОВАНІЙ
ДІЇ НИЗЬКОІНТЕНСИВНОГО ІОНІЗУЮЧОГО ВИПРОМІНЮВАННЯ**

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The features of the radiomodification effect of the biologically active additive (BAA) mumijo on the state of red blood indicators of 53 conditionally healthy women (UZH) – volunteers aged 33-52 years, living in Kropyvnytskyi under the conditions of constant combined action of low-intensity ionizing radiation of natural and man-made origin. Hematological methods were used in the work: using a hematological analyzer, the content of red blood cells, hemoglobin, hematocrit and statistical methods were studied: the results of the research were statistically processed using the Statistica 6.0 application software package (StatSoft, USA), using the student's t-criterion..

The conducted studies have shown the presence of a positive radiomodification effect of introducing a course of biologically active supplement (BAA) mumijo into the diet on the indicators of red blood with a combined constant effect of natural and man-made low-intensity radiation on the body of conditionally healthy women. The obtained radiomodification effect is manifested by normalization or tendency to normalization of red blood parameters positive probable changes in red blood cells and peripheral blood hemoglobin were recorded in conditionally healthy women living in Moscow. Kropyvnytskyi under the constant combined influence of natural and man-made ionizing radiation. Studies have shown a significant positive effect (BAA) of mummies on hemoglobin. After the course (BAA) of mumijo, an increase in the previously reduced hemoglobin content in the red blood cell was recorded, and a likely increase in the average MCH values to the average values within the normal range for women. At the same time, the indicators of the average concentration of hemoglobin in the erythrocyte mass (MSNS), which were within the normal range, significantly increased after the course (BAA) of mumijo and went beyond its limits.

Keywords: *combination, constant low-intensity ionizing radiation of natural origin, constant low-intensity ionizing radiation of man-made origin, radio modification, mummy.*

Significant territories of Ukraine are located on geological platforms with radioactive emanations. In these territories, a constant negative impact on the human body of natural low-intensity ionizing radiation is recorded [1, 2].

Kirovohrad region, which is geographically located in the middle part of the central Ukrainian Crystal Shield, the bowels of which are very rich in uranium deposits.



The release of radioactive elements that provide ionizing radiation of man – made origin in this area is associated with the activities of uranium mining enterprises [3-6], and can negatively affect the environment and the human population. So, according to research conducted in the city of Kropyvnytskyi and the regions of the state institution «Kirovohrad Regional Center for Disease Control and Prevention of the Ministry of health of Ukraine», the main contribution (up to 100 %) to the total effective dose of radiation to the population from sources of natural origin is made by internal radiation of the lungs with radon and its daughter decay products estimated in the range from 1.7 to 39.1 mSv/year. Previous studies conducted in the Kirovohrad region, in particular in Kropyvnytskyi, showed negative blood changes in both children and conditionally healthy adult sacs [3 – 5]. To reduce the impact of constant exposure to low-intensity ionizing radiation on the health of residents, it is necessary to develop adequate measures taking into account the negative effects of man-made factors that occur in specific areas of residence. Dietary products with biologically active action (HDP dietary supplements) are the most suitable for restoring the main body systems in the general population under the influence of negative environmental factors [7-11].

The purpose of this work is to study the effect of the biologically active additive (BAA) mumijo on the state of red blood parameters in conditionally healthy individuals in conditions of constant combined action of low-intensity ionizing radiation of natural and man-made origin.

Materials and methods

Peripheral blood parameters were studied in 53 conditionally healthy female volunteers aged 33-52 years living in Kropyvnytskyi. Mumijo was used as a food additive – the composition includes a large amount of inorganic (calcium, iron, magnesium, phosphorus, manganese) and organic (essential oils, amino acids, organic acids, vitamins) substances. Mumijo contains steroids, phospholipids, waxes, and fatty acids. Biologically active substances are involved in the hematopoietic process of the body, significantly improving it. Manufacturer: Aronia Pharm, Kyrgyzstan.

The subjects were grouped into 2 groups. The main group of women - 27 people (OG) after the examination received, in addition to food, a course of biologically active supplement (BAD) mumiyo in a dose of 200 mg for 30 days, 1 time per day. and

26 people - the control group (CG), which did not receive this drug. The research was carried out with the help of an automatic hematological analyzer SFRI HEMIX 5-60 on the basis of the KNP "Polyclinic Association" of the Kropyvnytskyi City Council, a clinical and diagnostic laboratory with further processing of the material on the basis of the Department of Microbiology, Virology and Immunology of the Donetsk National Medical University of the Ministry of Health of Ukraine (M. Kropyvnytskyi). Such parameters of red blood as the content of erythrocytes, hemoglobin, hematocrit (HNT), average volume of erythrocytes (MCV), average content of hemoglobin in an erythrocyte (MCH), average concentration of hemoglobin in an erythrocyte mass (MCHC), width of distribution of erythrocytes per volume were studied volume (RDW), the difference of the erythrocyte volume from the average value (RDW- cv), the relative width of deviation of erythrocytes by volume - standard deviation (RDW-sd), the content of platelets in the blood (PLT).



Results and their discussion

The conducted studies showed that before the course of dietary supplement (BAA) mumijo, the average content of red blood cells in individuals OG and KG was, respectively, 4.59 ± 0.07 t in 1 L and 4.58 ± 0.063 t in 1 L. Individual fluctuations in the content of red blood cells in the examined UZH from both groups ranged from 4.04 t in 1 L to 5.26 t in 1 L. In $27.02 \pm 1.54\%$ OG and $23.08 \pm 1.62\%$ kg, an increased content of red blood cells was recorded. A decrease in the content of red blood cells in individuals with OG and KG before the course (BAA) of mumijo in OG was not recorded. At the end of the mumijo course, the average content of red blood cells in KG individuals (4.6 ± 0.3 t per 1 L) practically remained at the level of initial data, and the frequency of detection of individuals with their increased content slightly increased – $26.92 \pm 1.70\%$. In individuals with OG after a course of mumijo, the red blood cell content tended to slightly decrease and amounted to 4.46 ± 0.08 t per 1 L. The frequency of detection of increased red blood cell content in individuals with OG significantly decreased to $18.75 \pm 1.45\%$ ($P < 0.05$).

Hematocrit values (HST) in individuals with OG and KG for the period up to the course of mumijo were $36.0 \pm 0.33\%$ and $36.62 \pm 0.32\%$, respectively, and had no deviations either individually or on average from the norm for women from 32% to 42%. After the course (BAA) of mumijo, hematocrit values tended to decrease in OG individuals and did not change in KG individuals, amounting to $34.23 \pm 2.37\%$ and $36.31 \pm 2.31\%$, respectively.

As can be seen from the data in Figure 1. a decrease in the average volume of red blood cells (MSV) was recorded in the examined contingent of individuals with OG and KG before the study. Accordingly, in patients with OG and KG, the average MSV values were 79.67 ± 0.58 FL and 79.58 ± 1.2 FL, while the norm for women was from 80 FL to 95 FL. Individual MSV fluctuations in both OG and KG were in the range of 77.0 FL – 82.2 FL. Reduced MSV was recorded in $44.4 \pm 1.84\%$ g and $42.31 \pm 1.90\%$. After the course (BAA) of mumijo, the average MSV values in KG practically did not change and amounted to 79.75 ± 0.99 FL. The frequency of detection of reduced MSV values remained unchanged – $42.31 \pm 1.90\%$. In contrast to individuals with KG, the frequency of indicators below the norm decreased to $33.3 \pm 1.75\%$ ($p < 0.05$) in individuals with OG after a course of mumijo (BAA), and the average MSV values significantly increased to 81.36 ± 0.21 ($p < 0.05$) and corresponded to the norm indicators. RDW-CV is an indicator of the relative width of the distribution of red blood cells by the coefficient of variation, a decrease in which indicates the presence of anisocytosis, and microcytic or macrocytic anemia itself, before the course (BAA) of mummies were at the lower limit of the norm (11-15%) in OG and KG were $11.82 \pm 0.17\%$ and $11.64 \pm 0.89\%$. For the period after the course (BAA) of mummies, there were no significant changes in these indicators, both in OG – $11.57 \pm 0.08\%$ and in KG – $11.31 \pm 0.47\%$. Thus, according to the RDW-CV indicator, anisocytosis of red blood cells in the examined contingents was not recorded. However, this indicator is considered insensitive to small populations of microcytes and macrocytes and is more informative for cases of macrocytic or microcytic anemia.

A more sensitive indicator of the presence of a small population of macrocytes or microcytes is RDW-SD – the relative width of the distribution of red blood cells by the



standard deviation coefficient –which gives an idea of the variability of red blood cells by volume. In the figure Fig. 2.data on the results of the study of the relative width of the distribution of red blood cells by the standard deviation coefficient are presented.

Before the course (BAA) of mummies in individuals with OG and KG, reduced RDW-SD values were recorded, which, respectively, amounted to 34.46 ± 3.04 FL and 34.52 ± 1.4 FL with normal values of 37.50 – 47.50 FL. At the same time, a decrease in the RDW-SD index was recorded in $66.67 \pm 1.5\%$ of patients with OG and in 53.80 ± 1.91 patients with Kgyu after the course (BAA) of mumijo, the relative width of the distribution of red blood cells by the standard deviation coefficient on average in patients with kg almost did not change and amounted to 33.4 ± 1.60 FL, and the frequency of detection of a reduced RDW-SD index increased to $65.38 \pm 1.83 \%$. In individuals with OG, in contrast to individuals with kg, after a course of (Baa) mummies, no reduced RDW-SD indicators were found, that is, in all individuals with OG, RDW-SD was within the normal range. The average RDW-SD values in the exhaust gas increased to the normal level, were significantly higher than the initial values (0.05) and amounted to 42.5 ± 0.55 FL.

Studies have shown a significant effect (BAA) of mummies on hemoglobin indicators. It was found that the total hemoglobin content (in red blood cells and blood plasma) in the UZH of the main (OG) and control group (kg) of M. Kropyvnytskyi to the course (BAA) of mumijo was, respectively, 134.83 ± 1.7 g/L and 135.01 ± 2.3 g/L. fluctuations in the hemoglobin content in OG and KG were in the range of 118 – 151 G/L with a norm of 120 – 140 g/L. in $22.20 \pm 1.5\%$ of OG individuals and $23.08 \pm 1.62\%$ kg showed increased hemoglobin values, and $7.4 \pm 0.96\%$ OG and $7.7 \pm 1.03\%$ kg showed reduced hemoglobin values. For the period after the course (BAA) of mumijo, people with KG did not register any likely changes in the content of hemoglobin indicators, the average values of which were 135.6 ± 1.8 G/L. the frequency of reduced hemoglobin indicators was $11.54 \pm 1.23 \%$, and increased indicators – $30.77 \pm 4.78 \%$. No reduced hemoglobin levels were recorded in patients with OG after a course of mumijo (BAA). An increase in the total hemoglobin content was detected in $31.25 \pm 1.71 \%$, which is significantly higher ($P < 0.05$) compared to the initial data. The average hemoglobin values in the OG after the course (BAA) of mumijo had a slight tendency to increase – 136.6 ± 2.3 g/l.

As can be seen from the data shown in. the average hemoglobin content in the MCH – erythrocyte individually fluctuated up to the course (BAA) of mummies, both in OG and in KG, in the range from 27.8 PG to 29.9 PG with normal values of 27 PG – 34 PG. That is, it was within the normal range, but near its lower values. MCH indicators that would go beyond the norm in individuals with OG and KG were not recorded. The average MSN values in G and G before the course (BAA) of mumijo were, respectively, 28.76 ± 0.28 PG and 28.9 ± 1.54 PKU for the period after the course (BAA) of mumijo, individual fluctuations in individuals of KG remained within the same limits as before the course of PM -27 PG – 34 PG, and the average values of MCH 28.5 ± 1.26 PG also practically did not change. An increase in the average hemoglobin content in the red blood cell was recorded in all patients with OG after a course of mumijo (BAA). At the same time, individual MSN fluctuations shifted to average values within the normal range and ranged from 30.3 PCs to 32.7 PCs. The



average values of MSN v_{og} after the course (BAA) of mumijo significantly increased to 31.4 ± 0.26 PG ($P < 0.05$).

As can be seen from the data shown in Figure 4, the average values of the average concentration of hemoglobin in erythrocyte mass (MCHC) in OG and KG before the course (BAA) of mumijo, respectively, were 353.33 ± 8.7 g/L and 352.42 ± 6.5 g/L with normal values lying in the range of 320 g/l – 360 g/l. individual indicators of MCHC, both in OG and KG individuals, ranged from 290 g/l to 368 that is, the indicators of the average hemoglobin concentration in the red blood cell mass ranged from those that were lower than normal for MCHC, to those that significantly prevailed. The detection rate of individuals with reduced MCHC values in OG and Kg, respectively, was $11.1 \pm 3.16\%$ and $7.69 \pm 1.02\%$, and individuals with increased values, respectively, $46.4 \pm 2.5\%$ and $40.7 \pm 3.2\%$. At the time after the course (BAA) of mumijo, individual fluctuations in MCHC values in KG were in the range of 330 - 368 G/L and were increased in $53.85 \pm 1.92\%$ of individuals ($P < 0.05$). The average MCHC values in KG were almost unchanged compared to the initial data and amounted to 358.5 ± 4.8 g/L. in contrast to KG, significant changes in MCHC were found in individuals with OG after a course of (Baa) mummies. The average concentration of hemoglobin in the erythrocyte mass, in contrast to the indicators of KG at the end of the course (BAA) of mumijo and the initial data of KG and OG, significantly increased to 386.11 ± 1.46 g/l ($p < 0.05$).

Thus, after the course (BAA) of mumijo, positive probable changes in red blood cells and peripheral blood hemoglobin were recorded in UZH living in Kropyvnytskyi under the constant combined influence of natural and man-made ionizing radiation. Thus, after the course (BAA) of mumijo in the main group, there was a decrease in the frequency of detection of individuals with an increased content of red blood cells and a tendency to normalize the average content of red blood cells and hematocrit to the average values of the norm for women. An increase in the average volume of red blood cells after the course (BAA) of mummies in OG individuals and an increase in the uniformity of red blood cells in size to the level of normal indicators were likely. Studies have shown a significant positive effect (BAA) of mummies on hemoglobin. After the course (BAA) of mumijo, an increase, previously reduced, in the hemoglobin content in the red blood cells of all OG individuals was recorded and a likely increase in the average OG MCH values to the average values within the normal range for women. At the same time, the indicators of the average concentration of hemoglobin in the erythrocyte mass (MSNS), which were within the normal range, significantly increased after the course (BAA) of mumijo and went beyond its limits ($P < 0.05$).

Conclusions

A positive radiomodification Valiv of the biologically active supplement mumijo was established regarding the indicators of red blood, which was reflected by a decrease after the course of the drug: the frequency of detection of persons with increased content, restoration to the norm of the average volume, an increase in the uniformity of red blood cells in size to the level of normal indicators, an increase in the average hemoglobin content in red blood cells and the average concentration of hemoglobin in the red blood cell mass, a likely increase in the average content of the average volume, restoration to the norm of the content of white blood cells.



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Досліджено особливості радіомодифікаційної дії біологічно активної добавки (БАД) мумійо на стан показників червоної крові 53 умовно здорових жінок (УЗЖ) – волонтерів у віці 33–52 роки, що мешкають в м. Кропивницькому в умовах постійної комбінованої дії низькоінтенсивного іонізуючого випромінювання природного і техногенного походження. В роботі використовувались гематологічні методи: з допомогою гематологічного аналізатора були досліджені вміст еритроцитів, гемоглобіну, гематокрит та статистичні методи: результати досліджень статистично опрацьовували за допомогою пакета прикладних програм Statistica 6.0 (StatSoft, USA), використовуючи t-критерій Стьюдента.



Проведені дослідження показали наявність позитивного радіомодифікаційного впливу введення до харчового раціону курсу біологічно активної добавки (БАД) мумійо на показники червоної крові при комбінованій постійній дії природного та техногенного низькоінтенсивного випромінювання на організм умовно здорових жінок. Отриманий радіомодифікаційний ефект проявляється нормалізацією або тенденцією до нормалізації показників червоної крові реєструвались позитивні вірогідні зміни щодо еритроцитів та гемоглобіну периферичної крові в умовно здорових жінок, що мешкають в м. Кропивницький під постійним комбінованим впливом природної та техногенної іонізуючої радіації. Проведені дослідження показали значний позитивний вплив (БАД) мумійо на гемоглобін. Після курсу (БАД) мумійо було зареєстровано збільшення, попередньо зниженого, вмісту гемоглобіну в еритроциті, та вірогідне підвищення середніх показників МСН до середніх значень в межах норми для жінок. При цьому показники середньої концентрації гемоглобіну в еритроцитарній масі (МСНС), що знаходились в межах норми, після курсу (БАД) мумійо вірогідно збільшились й вийшли за її межі.

Ключові слова: комбінація, постійне низькоінтенсивне іонізуюче випромінювання природного походження, постійне низькоінтенсивне іонізуюче випромінювання техногенного походження, радіомодифікація, мумійо.

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