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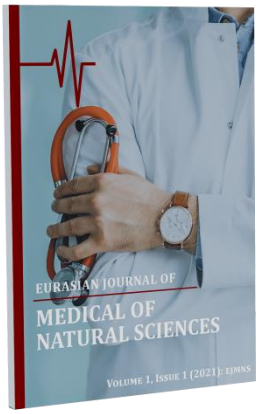

A STUDY OF LIPID METABOLISM IN REGULAR BLOOD DONORS

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ABSTRACT

62 donors aged from 20 to 55 years (33 men and 29 women) were examined. Among them, 29 people (17 men and 12 women) donated for the first time in their lives - they made up the first (I) observation group, and 33 donors (17 men and 16 women) were regular donors with a donation experience of more than two years and did not less than two donations annually—they formed the second (II) observation group. The article presents the results of a study of the morphological characteristics of erythrocytes in active blood donors and some parameters that characterize the physical properties of erythrocytes. It was concluded that active donation may be accompanied by changes in a number of morphological and physical characteristics of red blood cells.

INTRODUCTION

In human erythrocytes, during their life and performance of physiological functions, changes occur that are caused by the characteristics of metabolism, erythropoiesis, in particular, free radical oxidation of lipids and antioxidant protection in erythrocytes [1; 2]. Directly in the hematopoietic system, under the influence of certain factors, in particular the constant stimulation of the red germ of hematopoiesis due to regular donations in active donors, certain functional and morphological changes occur in red blood cells [2]. It is known that regular donation can be accompanied by changes in erythropoiesis, qualitative and quantitative changes in red blood cells [1; 2]. However, in the available literature we have not found any work that would provide a comprehensive assessment of such changes, which prompted us to conduct appropriate research.

MATERIALS AND METHODS

We have examined 62 donors aged 20 to 55 years (33 men and 29 women). Among them, 29 people (17 men and 12 women) donated for the first time in their lives - they made up the first (I) observation group, and 33 donors (17 men and 16 women) were regular donors with a donation experience of more than two years and did not less than two donations annually—they made up the second (II) observation group. The indicators of the number of erythrocytes

and hemoglobin content in the peripheral blood of all examined were within normal limits. Donors in observation group II could potentially have iron deficiency. Determination of the iron content in blood serum (BS) and the total iron-binding capacity of serum (TIBC) was carried out using the bathophenanthroline method.

RESULTS AND DISCUSSION

We present data on some erythrocyte indices of the examined patients (Table 1).

Table 1

Erythrocyte parameters in the examined individuals (X ± m)

Index	Group I (n = 29)	Group II (n = 33)
RBC, 10^{12}/l	4,62 ± 0,05	3,30 ± 0,15*
MCV, fl	86,01 ± 0,47	81,21 ± 0,41*
MCP, pg	28,95 ± 0,11	27,73 ± 0,37
MCHC, g/dl	33,12 ± 0,12	34,31 ± 0,04*
RDW,%	13,21 ± 0,06	13,99 ± 0,09*

Note: * p < 0.05 compared to control values.

Table 2

Indicators of erythrocyte cytometry in those examined (X ± m)

Index	Group I (n = 29)	Group II (n = 33)
Average diameter of an erythrocyte, μm3	7,22 ± 0,04	6,31 ± 0,03*
Proportion of micro- and schizocytes, fl	4,81 ± 0,11	6,21 ± 0,23*
Anisocytosis rate, %	4,01 ± 0,12	6,76 ± 0,13*
Discocytes, %	80,91 ± 0,47	72,11 ± 0,08*
Anomalous forms,%	19,07 ± 0,52	24,79 ± 0,11*

Note: * p < 0.05 compared to control values.

As can be seen from the data presented, significant changes in morphometric parameters were revealed in the peripheral erythron of regular donors. In addition to the above, a significant (p < 0.05) increase in the RDW indicator was revealed in those examined in group 1 compared with those examined in group 2.

Data on the cytometry parameters of erythrocytes in the examined patients are given in Table. 2.

In group 2 of those examined, a significant increase in the number of transformed erythrocytes (stomatocytes, echinocytes, etc.) was revealed, and, accordingly, a decrease in the number of normal discocytes, as well as a significant decrease in the average diameter of erythrocytes, an increase in the proportion of microcytes and an increase in the indicator anisocytosis. In addition to the above, pronounced poikilocytosis was detected, which was manifested by a significant decrease in the proportion of discocytes, an increase in echinocytes and irreversibly changed pre-hemolyzed forms of erythrocytes.

An increase in the number of echinocytes is always accompanied by an increase in blood viscosity. Rigid forms of erythrocytes, due to their loose fit to the wall of blood vessels, cannot

fully participate in gas exchange, which may favor the occurrence of hypoxic processes in tissues. The movement of altered cells in the total volume of capillary blood flow slows down, which can create a favorable background for the formation of microthrombi. In the erythrocyte formula in Group II of those examined against the background of a decrease in the average size of the diameter of erythrocytes and an increase in the rate of anisocytosis due to an increase in the proportion of microcytes, a significant decrease ($p < 0.01$) in the proportion of discocytes, an increase in the proportion of echinocytes and irreversible changes were observed. - non-pre-hemolyzed forms of erythrocytes, which can obviously affect the life expectancy of erythrocytes.

In primary donors, the indicator of hemoglobin content in peripheral blood erythrocytes, determined by the interferonometry method in picograms (pg), ranged from 20 to 50 pg or more, and in women the indicator of the number of erythrocytes with a hemoglobin level of 20-29 pg was 22.2% , 30-39 pg - 61.1%, 40-50 pg - 11.1%, more than 50 pg - 5.6% of the total number of red blood cells, in men, 23.8%, 61.9%, respectively, 9.5% and 4.8%. In active blood donors, a similar distribution of erythrocytes in terms of hemoglobin content was revealed.

Calculation of the reticulocyte formula may be of practical importance. In active donors, we found a significant increase in the number of reticulocytes in peripheral blood compared to the control group ($p < 0.05$). In addition, reticulocytes of groups 0, I and II were detected in blood smears, which indicated the presence of a left shift in the reticulocyte series. According to Heilmeyer, depending on the degree of maturity, V groups of reticulocytes are distinguished: group 0 - nucleated normoblasts with a dense spherical reticular network around the pyknotic nucleus; Group I - young red blood cells that do not contain a nucleus and have a dense spherical reticular mesh in the center of the cell; Group II - red blood cells with a moderately dense spherical reticular mesh, which is distributed throughout the cytoplasm; Group III - erythrocytes with thread-like remnants of the reticular mesh, which are localized in different parts of the cytoplasm; Group IV - red blood cells with individual threads or grains of reticulofilamentous substance in separate areas of the cytoplasm. A similar staging of the degree of maturation of reticulocytes was proposed by I.A. Kassirsky and G.A. Alekseev.

The parameters of erythrocytograms of donors of groups I and II were within normal values, but when comparing them in donors of group II, it was established that in the subgroup of donors with low values of ferritin in the blood serum, significant shifts of acid erythrocytogram fragments to the left were detected, which indicated the appearance of a certain number of unstable erythrocytes - E < 1`30″, and to the right - which indicated the appearance of persistent and highly resistant erythrocytes E > 7`30″. The expansion of the erythrocytogram to the left (with a normally located maximum and terminal fragments) may be due to an increase in the number of functionally defective erythrocytes, and to the right - the presence of young forms of erythrocytes and indirectly indicates the regenerative state of the bone marrow due to its constant incentives for regular donations.

CONCLUSION

1. We can draw a preliminary conclusion that with regular donation, significant changes in the morphometric characteristics of erythrocytes are observed, which is manifested by a decrease in the proportion of discocytes, an increase in the proportion of echinocytes and irreversibly changed pre-hemolyzed forms of erythrocytes.

2. In active donors, the regenerative function of the red germ of hematopoiesis is enhanced, which is manifested by an increase in the level of reticulocytes and a shift of the reticulocyte formula to the left.

3. The changes we identified in the erythrocyte unit of peripheral blood, on the one hand, are a reflection of age-related characteristics of hematopoiesis and, in particular, erythropoiesis under conditions of its constant stimulation and the development of latent iron deficiency, on the other hand, evidence of initial pathophysiological disorders in active donors.

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