

в 3,2 раза. Одновременно росла среди детского населения указанных областей и распространенность болезней - в 2,6 раза. Проведенный анализ состояния здоровья детского населения, проживающего в областях с территориями радиоэкологического контроля и подвергающегося постоянному опосредованному влиянию последствий аварии на ЧАЭС, свидетельствует о его прогрессивном ухудшении, которое соответствует общей динамике состояния здоровья детского населения страны. За последние 22 года разница в заболеваемости между детьми из областей с ТРК и другими областями увеличилась на 80,3%, а по сравнению с общегосударственным показателем разница выросла на 66,8%. Обращает на себя внимание высокое увеличение заболеваемости и распространенности новообразований, болезней эндокринной системы, болезней системы кровообращения, болезней мочеполовой и костно-мышечной системы, врожденных аномалий, деформаций и хромосомных аномалий, болезней уха и сосцевидного отростка, болезней органов дыхания. Темп роста заболеваемости по всем классам болезней у детей из областей с территориями радиоэкологического контроля за последние 22 года составил + 42,1% и был самым высоким по сравнению с аналогичными параметрами у детей из областей без ТРК, который составлял + 32,9%, при общегосударственном показателе рост + 36,09%.

Ключевые слова: дети, заболеваемость, распространенность, инвалидность, Чернобыльская катастрофа, загрязнение окружающей среды.

by 3,2 times. At the same time, among the children of these regions, the prevalence of diseases has grown by 2.6 times. Analysis of health status in the children living in areas with radioecological control territories and undergoing a permanent indirect impact of the Chernobyl accident consequences shows its progressive deterioration, which corresponds to the general dynamics of the health status in the country's children. Over the past 22 years, the difference in morbidity among children from the regions with the TRC and other areas has increased by 80.3%, and compared to the national indicator, the difference has increased by 66.8%. Attention should be drawn to the high incidence and prevalence of tumors, diseases of the endocrine system, diseases of the circulatory system, diseases of the genitourinary and musculoskeletal system, congenital anomalies, deformations and chromosomal abnormalities, ear and mastoid diseases, respiratory diseases. The rate of the incidence growth for all classes of diseases among children from regions with radioecological control territories for the latest 22 years was + 42.1% and was the highest in comparison with the similar parameters in children from regions without TRC, which makes + 32.9% with the national incidence growth rate of + 36.09%.

Key words: children, morbidity, prevalence, disability, Chernobyl disaster, environmental pollution.

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MORPHOMETRIC CHANGES OF BUCCAL EPITHELIOCYTES AND ERYTHROCYTES IN STUDENTS WITH VARIOUS LEVEL OF SOMATIC HEALTH AND GENERAL PHYSICAL HARDINESS

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The aim of the research was to study the morphometric changes in buccal epitheliocytes of students with different levels of somatic health and their correlation with the duration and quality of performance of the 12 min shuttle race with an acceleration of the run time of 20 m of segments. Indicative of the importance of morphometric examination of buccal epitheliocytes and erythrocytes of peripheral blood, as active participants in maintaining homeostasis and local factors of resistance of the body. Students with different levels of somatic health experience regular changes in the morphometric parameters of buccal epitheliocytes and erythrocytes of peripheral blood before and after testing the body's overall physical endurance. At the same time, the share of discocytes decreased dynamically and the content of spherocytes and stomatocytes increased. The results of the study show that when the maximum physical load is performed, the microrelief is significantly enriched and the peripheral blood erythrocytes are deformed, which indicates the low stability of their membranes to the effect of various stress factors at a low level of somatic health of the students. Different correlation between the obtained morphometric indices was demonstrated, and a direct correlation between the nuclear-cellsic ratio and the achieved level of shuttle run was revealed.

Key words: epitheliocyte, erythrocyte, morphometry, nuclear-cellsic ratio, somatic health, general hardiness.

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The data of scientific literature [3, 4, 10], indicate significant changes in the homeostasis of the human body at maximum physical loading (FL_{max}). At the same time, the first link to which it affects the level of the whole organism is the immune system, and in the first place – its non-specific part: local immunity [14]. The work of various authors shows the special sensitivity of this part of the immune response of the body to physical activity not only athletes [15], but also in people who are not engaged in sports [10, 11] or are in a state of psycho-emotional or immobilization stress [5, 8, 12], with diseases of various organs, etc. [2, 7, 14]. In this respect, the mucous membrane of the oral cavity is of particular importance, since in many works [2] its high sensitivity to various factors is proved in both physiological and pathological conditions [9, 13].

The adhesion of bacterial flora and the penetration of other stimuli into the deep layers of the mucous membrane of the oral cavity prevents the multi-layered uncured and partially keratinized epithelium [14]. Therefore, its morpho-functional state has a leading role in the development of restorative processes and maintenance of homeostasis due to the combined participation of mechanisms of activation of nonspecific and specific immunity. This is ensured by the fact that buccal epithelial cells, in addition to the function of a mechanical barrier and participation in phagocytosis, can be antigen-producing cells capable of secreting a number of biologically active substances: proinflammatory cytokines, chemokines, growth factors, etc. [8, 11, 14]. Suffice it to note that epithelial cells of the mucous membranes synthesize an additional secretory component "s" that joins the immunoglobulin A (IgA) molecule produced by tissue lymphocytes that leave the bloodstream through the wall of the hemocapillaries in various sections of the oral mucosa. At the moment of passing the IgA molecule through the epithelial cells, a complex of sIgA is formed. Accordingly, this product of co-operation of epithelial and plasma cells neutralizes bacterial toxins, localizes viruses, stimulates phagocytosis, that is, provides local resistance to the body at the level of the oral cavity [6, 10].

Taking into account that at the FL_{max} in various organs and tissues of the body there are disorders of microcirculation [3, 12, 13], it is quite natural that they primarily concern violation of the rheological properties of peripheral erythrocyte. Since these changes contribute to hypoxia and increase the phenomena of peroxidation of proteins and lipids [7, 15], it can be assumed their influence on the violation of energy metabolism at the cellular level in the form of morphometric changes in buccal epitheliocytes [9].

According to some authors [5, 10, 12, 13], one of the informative indicators of the level of cellular metabolism is the morphological changes of erythrocyte and buccal epitheliocytes, which are widely used in the diagnosis of various states of the human body and animals. With the help of the method of exfoliative cytology, the determination of the perimeter, the area of the nucleus and the cells and their correlation in the epithelial cells, as well as changes in the form of erythrocyte can be evaluated in a complex manner, which increases the effectiveness of the research [7, 11, 15].

This is especially true in the absence of pronounced dental symptoms in practically healthy students after testing the overall physical endurance of the body. However, morphometric changes in buccal epitheliocytes can be related not only to the systemic effects of FL_{max} , but also to correlate with the state of somatic health [11]. Therefore, the possibility of interaction and co-operation of buccal epitheliocytes with immunocompetent cells and the ability to perform a barrier function depends on their functional state, which may change under the influence of exogenous and endogenous factors, such as the level of somatic health, FL_{max} and the state of the erythrocytes [2, 7, 10, 13, 15].

The purpose of the work is to study the morphometric changes in buccal epithelial cells and erythrocytes of peripheral blood in students with different levels of physical health after maximal physical activity.

Materials and methods. In order to achieve this goal, an estimation of morphometric indices of buccal epitheliocytes was performed in 48 undergraduate students of the Precarpathian National University named after Vasyl Stefanik at the age of 17 years. The level of somatic health was determined by G.L. Apanasenko [1]. All students at the level of somatic health are divided into 2 groups: 1st group – 20 students with a higher secondary level, 2nd groups – 20 students below the average level of FL_{max} . To the control group included 20 practically healthy students with a higher average level of somatic health who did not participate in the testing of general physical exhaustion.

The study did not include students with active inflammatory processes in the oral cavity, endocrine disorders (diabetes mellitus), diseases of the organs of the gastrointestinal tract, periodic physiological changes in the female body [2, 6]. These exceptions were due to the fact that the above states of the body directly affect the state of buccal epithelial cells during the study, as well as the fact that these students, as a rule, receive therapy for concomitant pathology that can affect red blood cells and cytological picture of the mucous membrane of the cavity mouth.

Cytological and morphometric studies were performed on fingerprint smears of the epithelium of the cheek according to the generally accepted protocol [6]. After rinsing the oral cavity with a physiological solution, the end of the sterilized dental spatula with a slight pressure pressed the contents of the inner surface of the epithelium of the cheeks in the area of the molars and transomatic healththerred it to the slide with the drying of the stroke for 2-3 minutes in the open air.

Cytological preparations were painted with azur and eosin and they were viewed on a light microscope "Leika DME". In order to obtain a photo of cells in a light microscope, the Olympus Camedia C-480 ZOOM (Olympus corp., Japan) digital camcorder was used at x 400-1200 magnification.

The morphometric determination of the perimeter of the nucleus (P_n) and the cells (P_c) and the corresponding indices of the area of the nucleus (S_n) and the cells (S_c) on the cytological preparations of the buccal epithelium was carried out using of the computer programs BioVision 4,0. The frequency of cells with anomalies was determined in terms of 1000 cells.

A correlation analysis of the nuclear-cells ratio (S_n/S_c) and (P_n/P_c) was conducted to determine the possible connection of changes in a separate indicator with the duration of FL_{max} , which was determined by the number of levels of performance of 12 minutes of test.

The statistical processing of the results of the study was carried out using the standard statistical program package "Statistica 5 for Windows". For data processing, an analysis of the correspondence of the obtained data to the normal law of the distribution of random variables was performed. The results are presented in the form of averages and their errors ($M \pm m$). The comparison of mean values was performed using the Student's t-criterion. Statistical analysis of data was performed at a given probability (0,95), the results were considered statistically significant at $p < 0,05$. To determine the relationship between the perimeter ratio and the area of the nucleus to the perimeter and the area of the cells (P_n/P_c and S_n/S_c) of buccal epithelial cells after the FL_{max} , the duration of the 12 min test was carried out by multiple linear regression analysis using the step-by-step method [6, 14].

Results and their discussion. At the time of the study, all students on the basis of compulsory medical examination for students of the Faculty of Physical Education and Sports had been verified on the basis of international criteria and standards for the diagnosis of health of students in Ukraine [1]. The next level of somatic health: higher than average level of somatic health was determined in 25,0%, average – at 38,0% and below the average level of somatic health – in 47,0% of people. Students with high and low levels of somatic health have not been identified.

Morphometric analysis of buccal epithelial cells of students after FL_{max} recorded a probable increase in perimeter and area of the nucleus and a decrease in the corresponding indices determined for the cells of these cells. Correspondingly, in comparison with control group, an increase in the index of nuclear-cellsic ratio – P_n/P_c and S_n/S_c (Table 1) was observed. To determine the relationship between the perimeter ratio and the area of the nucleus to the perimeter and the area of the cells (P_n/P_c and S_n/S_c) of buccal epithelial cells after the FL_{max} , the duration of the 12 min test was carried out by multiple linear regression analysis (Fig. 1) using the step-by-step method. Taking into account the results of the conducted studies, a correlation analysis was carried out and between the obtained relative indicators in order to determine possible interconnections (Fig. 2).

Table 1

Morphometric indices of epithelial cells in students of the studied groups after testing of general physical hardness ($M \pm m$)

Indicators	1 st group (n=20)	2 nd group (n=20)	Control (n=20)
$P_c, \mu m$	$188,4 \pm 2,44^*$	$179,8 \pm 3,20^*$	$192,4 \pm 3,26$
$P_n, \mu m$	$32,6 \pm 0,27^*$	$35,2 \pm 0,36^*$	$30,4 \pm 0,42$
P_n/P_c	$0,17 \pm 0,003^*$	$0,21 \pm 0,005^*$	$0,15 \pm 0,001$
$S_n, \mu m^2$	$61,4 \pm 2,52$	$71,4 \pm 1,28^*$	$53,8 \pm 1,22$
$S_c, \mu m^2$	$2032,5 \pm 60,11^*$	$1918,7 \pm 68,53^*$	$2156,3 \pm 73,41$
S_n/S_c	$0,03 \pm 0,001^*$	$0,05 \pm 0,001^*$	$0,02 \pm 0,001$

Note: * the difference is probable compared with the control, $p < 0,05$

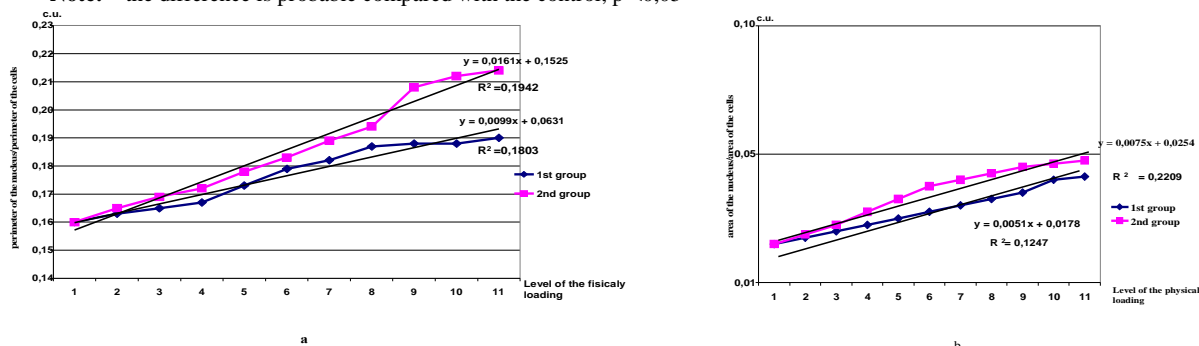


Fig. 1. Dynamics of changes and graphic representation of the correlation relationship between changes in the ratio of the perimeter of the nucleus and the cell (a) and the area of the nucleus and cells (b) in students, depending on the level of somatic health: 1st group – with a higher average and average level of somatic health; 2nd group – below the average level of somatic health.

In the main group, there was a strong positive correlation between morphometric indices such as P_n and S_n ($r_s = 0,96$; $p < 0,05$), P_c and S_c ($r_s = 0,97$; $p < 0,05$), as well as S_n/S_c to P_n/P_c ($r_s = 0,95$; $p < 0,05$). The average inverse-proportional correlation between the values of P_c and P_n/P_c ($r_s = -0,71$; $p < 0,05$), P_c and S_n/S_c ($r_s = -0,64$; $p < 0,05$) was observed, and S_n to P_n/P_c ($r_s = 0,34$; $p < 0,05$), and S_c to S_n/S_c ($r_s = -0,63$; $p < 0,05$).

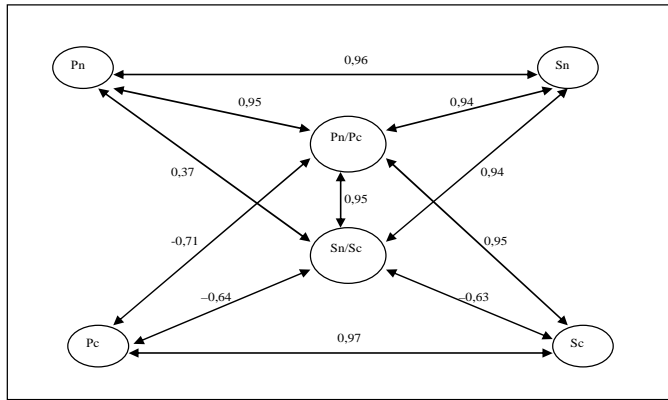


Fig. 2. A schematic representation of the correlation relations between the morphometric indices of buccal epitheliocytes in students after a 12-minute test run of a shuttle running in 20-meter intervals with an increase in the speed of running each segment.

In the process of statistical data processing, the presence of a weak positive correlation between P_n and P_n/P_c ($r_s = 0,33$; $p < 0,05$), P_n and S_n/S_c ($r_s = 0,37$; $p < 0,05$), S_n and P_n ($r_s = 0,34$; $p < 0,05$), as well as between S_n and S_n/S_c ($r_s = 0,42$; $p < 0,05$) (Fig. 2). The manifestation of the first signs of the reaction of erythrocyte to FL_{max} in students 1st and 2nd was marked by an increase in the proportion of spherocytes and a progressive decrease in the proportion of discocytes (Table 2). After 12 minutes of shuttle running, there is also an increase in the proportion of stomatocytes, while the number of ovalocytes did not differ from those in the control group.

Table 2

Relative content (%) of erythrocytes of peripheral blood of various forms in students depending on the level of somatic health before and after performing the maximum physical activity

Form of erythrocytes	Group				
	first		second		Control
	before	after	before	after	
Discocytes	60,8	60,3	44,8	36,2*	65,4
Discospherocytes	22,8	28,3	29,3	31,5*	34,3
Spherocytes	3,3	3,7	7,3	12,9*	2,5
Stomatocytes	2,4	4,8	4,6	6,1*	2,4
Ovalocytes	2,1	2,3	2,7	3,9*	2,2

Note: * – the difference is probable compared to control, $p < 0,05$.

In the blood of students of 1st group discoscities prevailed – 65,7% and discosomatic healtherythrocytes – 25,2%. The proportion of atypical forms of erythrocytes was minimal: spherocytes – 3,1%, stomatocytes – 4,0% and ovalocytes – 2,0%. Students in the 2nd group revealed significant deviations from the values of control group students (see Table 2) and 1st group students (Fig. 3).

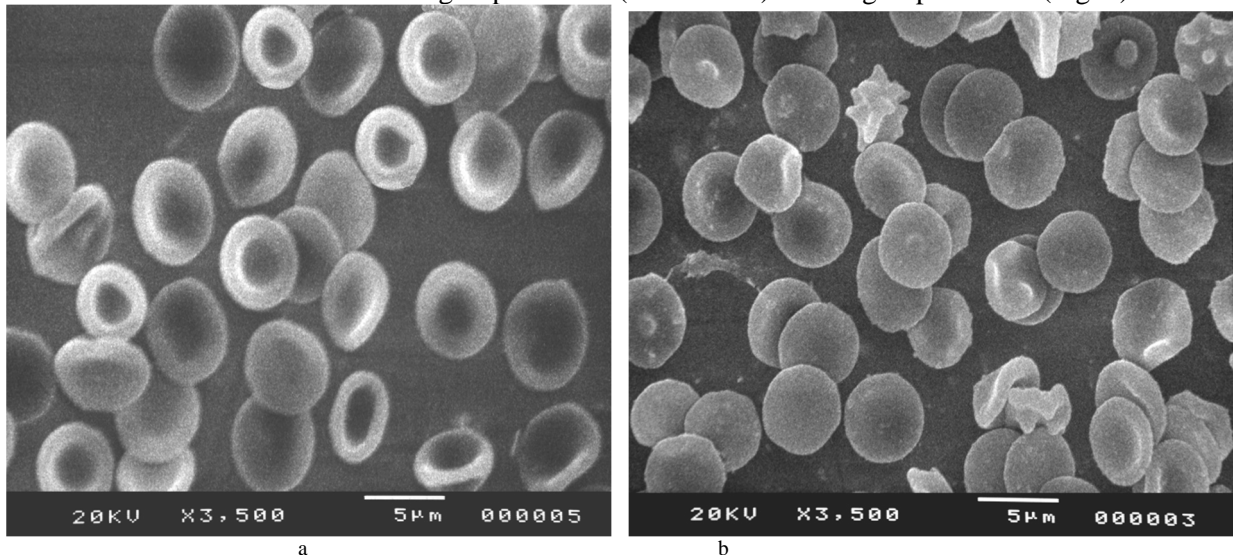


Fig. 3. Form of erythrocytes of peripheral blood in students 1st group (a) and 2nd groups (b) after the execution of 12 minutes shuttle run. Method: scanning electron microscopy.

Conclusion

1. Morphometric analysis of buccal epitheliocytes revealed a probable increase in perimeter and area of the nucleus, as well as a decrease in the above-mentioned indicators for cells in students after the maximum physical loading compared with the control group ($p < 0,05$).
2. Detected morphometric changes of buccal epitheliocytes and erythrocytes of peripheral blood at maximum physical loading may be due to the level of somatic health, which affects the deformability of red blood cells in students of the second group, restricts the production of young, functionally active cells and leads to a delay in the processes of differentiation of buccal epithelial cells with an increase in the number of aging cells with increased nucleus.
3. The increase in the number of different forms of peripheral erythrocyte against the control groupground of an increase in the

index of nuclear-cellsic ratio of buccal epithelial cells in students of all groups has a probable positive correlation relationship with the number of achieved levels of execution of 12 minutes of shuttle run with an increase in the pace of the passage of each 20 m segment.

Prospects for further research. Promising are further complex studies of changes in the buccal epithelial cells and erythrocytes of peripheral blood in students of different sexes after the maximum physical loading.

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Реферати

МОРФОМЕТРИЧНІ ЗМІНИ БУКАЛЬНИХ ЕПІТЕЛІОЦИТІВ ТА ЕРИТРОЦИТІВ У СТУДЕНТІВ З РІЗНИМ РІВНЕМ СОМАТИЧНОГО ЗДОРОВ'Я І ЗАГАЛЬНОЇ ФІЗИЧНОЇ ВИТРИВАЛОСТІ

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Мета дослідження – вивчити морфометричні зміни буквальних епітеліоцитів студентів з різним рівнем соматичного здоров'я та їх кореляційні співвідношення з тривалістю та якістю виконання 12 хв човникового бігу з прискоренням часу пробігу відрізків по 20 м. Вказується на важливість морфометричного дослідження буквальних епітеліоцитів та еритроцитів периферичної крові, як активних учасників підтримки гомеостазу і місцевих факторів резистентності організму. У студентів з різним рівнем соматичного здоров'я виявляються закономірні зміни морфометричних показників буквальних епітеліоцитів та еритроцитів периферичної крові до і після тестування загальної фізичної витривалості організму. При цьому динамічно знижувалася частка дискоцитів і збільшувалася вміст сфероцитів і стоматоцитів. Результати дослідження показують, що при виконанні максимального фізичного навантаження відбувається значне збагачення мікрорельєфу і збільшення деформабельності еритроцитів периферичної крові, що свідчить про низьку стійкість їх мембрани до впливу різних стрес-факторів у студентів з

МОРФОМЕТРИЧЕСКИЕ ИЗМЕНЕНИЯ БУКАЛЬНЫХ ЭПИТЕЛИОЦИТОВ И ЭРИТРОЦИТОВ У СТУДЕНТОВ С РАЗНЫМ УРОВНЕМ СОМАТИЧЕСКОГО ЗДОРОВЬЯ И ОБЩЕЙ ФИЗИЧЕСКОЙ ВЫНОСЛИВОСТИ

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Попель С.Л.**

Цель исследования – изучение морфометрических изменений в буквальных эпителиоцитах студентов с различным уровнем соматического здоровья и их корреляция с продолжительностью и качеством выполнения 12 мин челночного бега с ускорением времени пробегания отрезков по 20 м. Указывается на важность морфометрического исследования буквальных эпителиоцитов и эритроцитов периферической крови, как активных участников поддержания гомеостаза и местных факторов резистентности организма. У студентов с различным уровнем соматического здоровья выявляются закономерные изменения морфометрических показателей буквальных эпителиоцитов и эритроцитов периферической крови до и после тестирования общей физической выносливости организма. При этом динамично снижалась доля дискоцитов и увеличивалось содержание сфероцитов и стоматоцитов. Результаты исследования показывают, что при выполнении максимальной физической нагрузки происходит значительное обогащение микрорельефа и увеличение деформабельности эритроцитов периферической крови, что свидетельствует о низкой устойчивости их мембраны к воздей-

низьким рівнем соматичного здоров'я. Продемонстровано різний кореляційний взаємозв'язок між отриманими морфометричними показниками, а також виявлена пряма кореляційна залежність між ядерно-цитоплазматичних співвідношенням і досягнутим рівнем виконання човникового бігу.

Ключові слова: епітеліоцит, еритроцит, морфометрія, ядерно-цитоплазматичне співвідношення, соматичне здоров'я, загальна витривалість.

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ствиню різних стресс-факторів при низькому рівні соматичного здоров'я студентів. Продемонстрована різна кореляційна взаємозв'язок між отриманими морфометричними показателями, а також виявлена пряма кореляційна взаємозв'язок між ядерно-цитоплазматичним співвідношенням і досягнутим рівнем виконання челночного бега.

Ключевые слова: эпителиоцит, эритроцит, морфометрия, ядерно-цитоплазматического соотношения, соматическое здоровье, общая выносливость.

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THE DEPENDENCE OF THE AFFECTIVE DISORDERS MANIFESTATION ON MORPHOFUNCTIONAL CONDITION OF THE BRAIN AFTER TRAUMATIC BRAIN INJURY

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The occurrence and degree of psychiatric disorders manifestation mainly depends on the morphofunctional state of the brain. Generally, the prevailing number of military personnel who took part in combat operations suffers from post traumatic stress disorder and sustained traumatic brain injury. The purpose of the present study was to determine the dependence of the affective disorders manifestation on the brain's morphofunctional state after traumatic brain injury. Once the informed consents were collected, 60 patients, aged 19 to 60 years, who participated in the combat operations and suffered from non-psychotic psychiatric disorders and received in-patient treatment at one of the units of the O.F. Maltsev Poltava Regional Clinical Psychiatric Hospital during the period from 2014 to 2016 were examined. The performed studies' results demonstrate that the manifestation degree of psychiatric disorders depends upon the morpho-functional condition of the brain. Patients with post-traumatic stress disorders and psychiatric disorders caused by the injured brain (due to craniocerebral injury) should receive the compulsory comprehensive psychotropic and vascular therapy.

Key words: morpho-functional condition of the brain, craniocerebral injury, post traumatic stress disorder

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Currently, Ukraine is experiencing complicated socio-political situation. Tens of thousands of people have been forced to leave their homes and temporarily move to other regions of our country, lost their houses and relatives; there are injured and lost. More and more people become combatants. Exposure to the life-threatening events inevitably leads to a variety of negative health-psychological and social-psychological sequelae. The clinical picture of mental pathology in such people is represented by a wide range of disorders of different structure and manifestation: from psychologically understandable reactions and pre-disease states to clinically defined forms of pathology, where posttraumatic stress disorders (PTSD) and adaptation disorders (AD) prevail. The predominant number of military personnel who took part in combat operations suffers from the above pathology following the traumatic brain injury (TBI) [1, 15, 7, 12]. However, unfortunately, the vast majority of them have not been provided with timely neurologic examination.

Recently, the incidence of traumatic brain injury has been increased from 25 to 80% of the total incidence of neurological diseases. Notwithstanding the significant achievements of the contemporary medicine and numerous scientific studies on this issue, traumatic brain injury is one of the leading causes of mortality and disability of the workable population in the industrialized countries. The contemporary researchers report that traumatic brain injury takes the leading place among the causes of mortality in young and adult population, leaving behind tumor and vascular diseases. 30 – 90% of individuals, who sustained TBI in the form of brain concussion or moderate and severe brain contusion, suffer from brain diseases [2, 10]. Following the TBI, the majority of individuals, as a consequence, have more or less manifested psychiatric disorders. The delayed referral to psychiatrists leads to worsening of the mental state and the absence of adequate and necessary specialized medical care can lead to the life-threatening sequelae. The mechanisms of brain damage at the time of injury are well elucidated in the contemporary scientific publications. The effect of the kinetic energy onto the skull causes acceleration- deceleration, shift and rotation of the brain, diffuse axonal injury. The factors of the secondary lesions of the brain