INTRODUCTION
Diseases of periodontal tissues both of adults and children are the most common pathology in dentistry. Generalized periodontitis has not only different manifestations of the clinical picture of the disease of individual patients, but also in the dynamics of the pathological process in the periodontal disease of a particular patient [1]. The development of generalized periodontitis should be considered as the result of the interaction of the microbial factor and the patient’s body. Currently, the influence of microbial, traumatic, immune, vascular and other local factors in the development of generalized periodontitis has been studied in various ways. The features of the course of the background of the concomitant pathology of the organism are studied. On the one hand, the course of the local inflammatory reaction depends on the immunobiological properties of the body of this patient, on the other - the inflammation center in the tissues of the periodontal affects the whole organism. There occurred the closed circle that worsens the repairation of damaged tissues and restoration of immune homeostasis [2].

The reasons for the lack of a steady effect after periodontitis treatment can be both dysbiotic phenomena in the oral cavity with a violation of the stability of normal microflora, and changes in the reactivity of the organism as a whole. This is facilitated by the growth of aggressiveness of the environment, the influence of stress factors, increase in the number of people with different types of immunodeficiency among the population, inappropriate use of antibiotics. It is possible that complex therapy of generalized periodontitis, which includes the use of antimicrobial agents with a wide spectrum of action, can contribute to total suppression of the indigenous microflora of the oral cavity and all parts of the immune defense [3].

Taking into account the patho-immune mechanisms of the formation of the inflammatory process in the periodontium, there is a necessity for in-depth study of the pathogenesis of periodontal diseases from the standpoint of changes in the reactivity of the organism. The study of the latter factor is devoted to a series of studies in which morphological features of the development of periodontal inflammatory diseases were studied when the body reactivity changed [4]. In the development of

### OCENA STOPNIA FAGOCYTOZY U ZWIERZĄT EKSPERIMENTALNYCH Z CHOROBAMI PRZYZĘBIA WYWOŁANYMI ZMODYFIKOWANĄ REAKTYWNOŚCIĄ

Oleksandr V. Avdeev, Roksana O. Drevnitska, Alina B. Boykiv, Oksana Ya. Vydoinyk
STATE INSTITUTION OF HIGHER EDUCATION «I. HORBACHEVSKY TERNOPIL STATE MEDICAL UNIVERSITY OF THE PUBLIC HEALTH OF UKRAINE», TERNOPIL, UKRAINE

ABSTRACT
Introduction: Taking into account the patho-immune mechanisms of formation of inflammatory process in periodontium, there is a necessity for in-depth study of the pathogenesis of periodontal diseases from the position of changes in the reactivity of the organism.

The aim: Carrying out a comparative estimation of phagocytic activity of leukocytes of animals with inflammation in periodontium with altered reactivity.

Materials and methods: Experiments were performed on 30 white rats: Group I - 10 white rats with hypoergic reaction; Group II - 10 white rats with hyperergic reaction; Group III - 10 white rats with normergic reaction - control group. Slaughter and blood sampling under thiopental anesthesia was performed 7 days after the beginning of the experiment. The percentage of phagocytic leukocytes - phagocytic index, phagocytic number were determined and the index of phagocytic activity was calculated.

Results: The phagocytic index (FI,%) decreased by 2.09 times (p <0.05) at hypoergic, it increased by 1.37 times (p <0.05) at hyperergic; the index of phagocytic activity (IFA) decreased by 1.96 times at hypoergic (p <0.05); growth was 1.94 times (p <0.05) in the hyperergic group of animals. In both experimental groups, the phagocyte number (Fu) increased by 6.25% and 41.7%, with hypoergic and hyperergic, respectively.

Conclusions: Different directions of changes of the phagocytic activity were observed: increase of these parameters at hyperergic and decrease at hypoergic. An increase in phagocyte number was likely to indicate some autonomy of the process of phagocytosis and independence from the reactivity of the organism.

KEY WORDS: periodontitis, serum, phagocytic activity
inflammatory reaction, an important component is the elimination of necrotic masses, which have all the signs of antigenicity and ensure the process of remodeling. The control over the implementation of these processes is carried out by the immune system. One of the initiators of such an organism’s response is macrophages, which belong to bonded antigen-presenting cells. Taking into account ambiguous data from scientific sources, we conducted studies on immunological changes in the organism of experimental animals in response to altered reactivity, in particular, phagocytic activity of leukocytes, which may give an explanation of the triggering mechanisms of damage and, above all, to act purposeful therapeutic measures.

THE AIM
Carrying out a comparative estimation of phagocytic activity of leukocytes of animals with inflammation in a periodontium with altered reactivity.

MATERIALS AND METHODS
Experiments on animals were carried out in accordance with the European Convention for the Protection of Vertebrate Animals, which are used for experimental and scientific purposes (Strasburg, 1986), norms of biomedical ethics and relevant laws of Ukraine. The Bioethics Commission of the I. Horbachevsky Ternopil State Medical University violations of these principles were not detected (Minutes No. 44 of January 15, 2018).

Experiments were conducted on 30 white non-linear male rats weighing 180–200 g, 5–6 months old, which were divided into three groups: Group I - 10 white rats with hyperergic reaction; Group II - 10 white rats with hyperergic reaction; The third group - 10 white rats with normergic reaction - control group, which received 1 ml of saline solution intramuscularly. The modeling of the hyperergic reaction was carried out by intramuscular administration of the alkylating cytostatic cyclophosphamide (ISC “Kyivmedpreparat”, Ukraine) within 7 days daily at the rate of 10 mg / kg [7]. The simulation of the hyperergic reaction was carried out by intramuscular administration of a immunostimulant of polysaccharide nature - pyrogenal (NIIEМ named after M. F. Gamaleya RAMS, Russia) within 7 days daily at the rate of 10 mg / kg per animal in saline solution [8].

Slaughter and blood sampling under thiopental anesthesia was performed 7 days after the beginning of the experiment.

Determination of phagocytic activity of leukocytes is based on the ability of polymorphonuclear leukocytes and monocytes of peripheral blood to adsorb on its surface, absorb and digest microbial test culture. The following parameters were determined: the percentage of phagocytic leukocytes - the phagocytic index - the number of leukocytes from the hundred that showed phagocytic activity, the phagocytic number - the number of microbes absorbed by an average of one leukocyte and the index of phagocytic activity was calculated [9]. Quantitative indicators were processed by the method of variational statistics [10].

RESULTS AND DISCUSSION
Under the conditions of the changed reactivity of the organism, the inflammatory process in the periodontal tissues appeared, which was manifested by a decrease in the body weight of the animals, hyperemia, swelling, bleeding, gum erosion, a decrease in the height of the gingival papilla, destruction of the circular ligament, bulging of the root of the tooth, and, as our previous studies indicated [4, 11], the appearance of periodontal pockets: at hyperergia - from 110 mm to 550 mm (covered by the epithelium), with hypoergia - from 88 mm to 792 mm (with prevalence of necrosis) below the level of the enamel-cement border, which corresponds to the average degree of gravity bones of periodontitis. At the same time, the analysis of the results suggests that there are certain disorders in the functioning of the immune system of the animal organism.

Thus, evaluating the spectrum of indicators of non-specific protection in the blood of experimental animals with periodontitis, we are convinced that most of them differed significantly from the control (Table 1).

The cells of the monocyte-phagocytic system are directly related to the development of the inflammatory process in the periodontal tissues. Substrates of this system play a key role in the implementation of a wide range of immune responses: from the activation of the pro-inflammatory cascade at the initial stages of its development, to the inclusion of anti-inflammatory mediator products systems. The evaluation of the condition of cells of the monocyte-phagocytic system, in particular segmental neutrophils of peripheral blood, showed that during hypoergia, the percentage of phagocytes cells decreased, i.e., the phagocytic index (Fi,%) by 2.09 times (p <0.05), with hyperergia it increased by 1.37 times (p <0.05). The analysis of phagocytic activity of leukocytes showed a decrease in the index of phagocytic activity (IFA) with hypoergia in 1.96 times (p <0.05). The growth of the above indicator of the hyperergic group of animals was 1.94 times (p <0.05). However, both hypo- and hyperergic activity increased the absorbent activity of each phagocyte cell - phagocyte count (Ffu) of 6.25% and 41.7%, at hypoergia and hyperergia, respectively.

Thus, discussing the results of the research, due to the indicator of phagocytic activity of leukocytes, our assumption that it changes with the change in the reactivity of the organism, was confirmed. The earlier carried out investigations of the state of phagocytosis in patients with localized and generalized juvenile periodontitis, chronic generalized periodontitis in comparison with healthy beings [6] indicates a low level of phagocytosis in patients with juvenile periodontitis (46% - 53% of patients), only 6% of patients with generalized periodontitis had reduced
phagocytosis. Phagocytosis has not changed since the initial periodontal treatment in all patients, suggesting that the reduction of phagocytosis cannot be a temporary phenomenon associated with the state of periodontal. These results suggest that depressed phagocytic reaction of the patients may be due to defects in polymorphonuclear leukocytes. In our case, we explain this by changing the reactivity of the whole organism. There are other opinions [12], when the cause of the change in the state of phagocytosis is called the local flow of P. gingivalis to the function of polymorphonuclear leukocytes, which become depressed, which contributes to a greater risk of developing periodontitis in the future. The study of phagocytic activity of leukocytes made the authors [13] to make a conclusion that the presence of sodium fluoride contributed to a significant increase of the phagocytic index against Streptococcus oralis, Streptococcus mutans, Streptococcus sobrinus and Streptococcus sanguis. The authors explain this change by the susceptibility of bacteria, at the same time, do not exclude the direct activating effect of fluorides on polymorphonuclear leukocytes. These studies do not contradict our conclusions. In addition, investigations of the development of periodontitis with changes in body reactivity are original. We have independently developed experimental models of periodontitis, the pathogenesis of this disease can be studied, preclinical trials of new drugs and treatments can be conducted on their basis.

**CONCLUSIONS**

The development of periodontitis of moderate severity in the form of a hypoergic and hyperergic experimental model is accompanied by a marked violation in the monocyte-phagocytic system. Different directions of changes of the phagocytic index and index of phagocytic activity were observed: increase of these parameters at hyperergia and decrease at hypoergia. An increase in phagocyte number was likely to indicate some autonomy of the process of phagocytosis and independence from the reactivity of the organism.

The obtained results indicate the presence of various mechanisms of development of the inflammatory process in the periodontium. Accordingly, there is the question of determining the nature of the inflammatory process in a particular patient for conducting or not conducting correction of the state of the immune system or in the direction of immunosuppression, or immunostimulation.

**REFERENCES**


Authors’ contributions:
According to the order of the Authorship.

Conflict of interest:
The Authors declare no conflict of interest

Initiative of the research work of the Chair of Pediatric Dentistry at the State Institution of Higher Education «I. Horbachevsky Ternopil State Medical University of the Public Health of Ukraine» “Study of metabolic homeostasis of the body in diseases of the oral cavity in people of different ages and optimization of their treatment and prevention” (state registration number 0116U004146).

CORRESPONDING AUTHOR
Alexander V. Avdeev
State Institution of Higher Education «I. Horbachevsky Ternopil State Medical University of the Public Health of Ukraine»
Maidan Voli, 1, 46001 Ternopil, Ukraine
tel.: +380978521694, +380663508440
e-mail: avalexandr@yahoo.com

Received: 30.11.2018
Accepted: 14.02.2019