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MEDICAL SCIENCES AND PUBLIC HEALTH

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EFFECT OF SPIRULINA ON PSYCHOLOGICAL TESTING IN CHILDREN

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Underground. The full-scale invasion of the aggressor, which has been going on in Ukraine for more than two years, resulting in worse physical and mental health outcomes and perpetrating a deprived situation [1]. Child refugees also frequently experience psychological distress, even if they do not meet the formal diagnostic criteria for post-traumatic stress disorder. They often exhibit other distress symptoms, primarily internalizing problems, which can be challenging to detect [2], but over time, they lead to psychosomatic disorders. The results shows that even children residing in host countries who are not directly affected by the war can also display difficulties in mental functioning [3]. And long-term exposure to stress at an early age is known to modulate the genetic influence on brain structure and cognitive function in children [4]. Among the complex of measures to overcome and prevent disorders caused by chronic stress in the cognitive sphere of children, it seems advisable to use herbal remedies with the properties of neuroprotectors. Such a remedy, according to the literature, can be spirulina [5-7].

Objective: to study changes in psychological testing indicators with the use of spirulina in children.

Participants and methods. 33 children of random sampling, aged 7 to 15 years, who were undergoing rehabilitation in a children's sanatorium, were examined. The inclusion of children in the study was carried out with the informed consent of the children's parents after providing detailed information about the procedure and purpose of the work. Psychological testing was carried out using several techniques recommended by the Ukrainian Scientific and Methodological Center for Practical Psychology and Social Work [8], as described earlier [9]. Spirulina was prescribed according to the scheme: 0.5 g 2 times a day for 10 days, then 1 g 2 times a day for 20 days. The children were divided into 2 groups: the 1st (n = 11) received, in a complex of rehabilitation measures for the pathology with which the children arrived at the sanatorium, spirulina, and was the main group; the 2nd (n = 22) received the same rehabilitation complex, but without spirulina, so it formed a control group. According to the peculiarity of the course of pregnancy and childbirth in the mother, the age of the children, their sex, the diseases from which the children suffered, the education and social status of their parents, both groups were balanced. The indicators at the beginning and at the end of the observation in each group were compared. Statistical processing of the results was carried out by the method of variation series using the Student's t-test, as well as analysis of variance was carried out using criterion F. Differences at $p < 0.05$ were considered reliable.

Results and discussion. As the results of the observation showed, the indicators of psychological testing in children before and after the course of rehabilitation significantly changed only in children of the 1st group, who received spirulina in a set of measures. Thus, the number of correctly reproduced images increased from (8.00 ± 0.73) to (10.64 ± 0.90) , $p < 0.05$. This indicates an improvement in memory in children in this group. At the same time, there was a decrease in the time of switching attention, defined as the difference between the time of working with the red-and-black table and the total time of working with the first and second Schulte tables: (147.18 ± 13.98) s at the beginning of the observation and (97.91 ± 9.35) s, $p < 0.05$ at the end of the observation. This indicates an improvement in the mobility of the processes of the nervous system.

Analysis of variance confirmed the positive effect of spirulina on these indicators. Thus, the score according to criterion F of the effect on the number of correctly reproduced images was 4.58, $p < 0.05$. The effect on the time of switching attention according to criterion F was 8.58, $p < 0.05$.

Changes in some of the other studied indicators (the number of correctly reproduced numbers, the number of memorized words reproduced after an hour, the number of errors when working with the red-and-black table) did not reach the degree of reliability, apparently due to the small number of children in the main group.



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In the control group, whose children did not take spirulina, there were no significant changes between the indicators at the beginning and at the end of the follow-up.

Positive changes in the psychological testing scores of children treated with spirulina can be explained, apparently, by its ability to influence one of the causes of cognitive impairment – oxidative stress in brain cells [5]. Spirulina contains a complex of antioxidants that scavenge free radicals and prevent oxidative stress in cells [7]. A lot of literature data, including those presented in modern systematic reviews, show a decrease in the indicators of excessive lipid peroxidation under the influence of spirulina and an increase in antioxidant protection [5-7]. This is evidenced by the results of our previous studies [10]. And the elimination of hyper lipid peroxidation in the membranes of cells, including the brain, helps to restore their structure and function, which provides the neuroprotective effect of spirulina.

All children tolerated the nutritional intervention well, and no adverse reactions were noted.

Conclusion. The obtained results indicate that the use of spirulina has a positive effect on such indicators of the cognitive sphere as the number of correctly reproduced images (which reflects the improvement of memory in the child) and the time of switching attention (which reflects the improvement in the mobility of the processes of the nervous system). The neuroprotective effect of spirulina is probably based on the correction of prooxidant-antioxidant homeostasis in brain cells.

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