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ASSESSMENT OF THE PREVALENCE OF IRON DEFICIENCY ANEMIA IN YOUNG PEOPLE: USING THE EXAMPLE OF FSU STUDENTS

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Relevance: Anemia is one of the most significant nutritional deficient conditions affecting various social groups and levels of socio-economic development. With a variety of causes, anemia can be of nutritional origin (iron, folic acid and vitamin B12 deficiency), hereditary (thalassemia, sickle cell anemia), due to environmental factors (lead), infectious (malaria), socio-economic (low maternal education, insufficient family income), related to demographic characteristics (age, gender), malabsorption (achlorhydria), autoimmune processes (hemolytic anemia) or chronic diseases (oncological pathology). Despite the widespread occurrence of iron in nature, its deficiency in humans is extremely common and is the leading cause of anemia worldwide. Iron deficiency anemia (IDA) is a global public health problem that is common in all countries and has serious health consequences, especially in pregnant women, infants, young children, and adolescents who are at increased risk for iron deficiency [1]. Iron enters the body in heme (animal) and non-heme (plant) forms; at the same time, heme iron has a higher bioavailability, which makes people who follow a vegetarian diet more vulnerable to the development of iron deficiency [2]. The process of iron absorption occurs mainly in the duodenum and is carried out with the participation of the bivalent metal transporter (DMT1) localized in enterocytes [3]. Next, iron is transported into the systemic bloodstream through ferroportin and binds to transferrin, which ensures its delivery to the bone marrow and liver for the synthesis of red blood cells and deposition. Intracellular iron stores bind to ferritin, which prevents cellular damage caused by the formation of free radicals. Since there are no active mechanisms of iron elimination in the body, except for blood loss and natural cell renewal [4], its total level is strictly controlled. Increased iron content and inflammatory processes stimulate the synthesis of hepcidin in the liver, which reduces iron absorption due to ferroportin degradation and inhibits the release of iron from the depot [5]. These mechanisms of iron metabolism regulation are of key importance for the pathogenesis, diagnosis, and therapy of iron deficiency anemia [6]. Iron is necessary for a variety of cellular processes, including enzymatic reactions, DNA synthesis, oxygen transport, and energy production in mitochondria [7,8]. As a result, its deficiency can lead to a potentially dangerous decrease in the number of red blood cells, impaired muscle function and energy metabolism. The discrepancy between the intake, absorption, and accumulation of iron, on the one hand, and its consumption or loss, on the other, underlies the development of IDA [9]. The clinical manifestations of iron deficiency anemia are very diverse and include shortness of breath, fatigue, palpitations, tachycardia and angina due to a decrease in blood oxygen capacity. The resulting hypoxemia can cause a compensatory decrease in intestinal blood supply, which leads to impaired motility and absorption, nausea, weight loss and abdominal pain. Hypoxia of the central nervous system is manifested by headaches, dizziness, lethargy and cognitive disorders.

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A number of studies have demonstrated an improvement in cognitive functions after correction of anemia [6, 10]. It has been reliably established that IDA significantly reduces the quality of life [10], while current evidence suggests that its treatment improves the quality of life regardless of the etiology of anemia [11]. As a rule, iron deficiency develops gradually and is asymptomatic for a long time until anemia reaches a pronounced degree. In students, the main cause of iron deficiency anemia is insufficient intake of bioavailable iron from food, as well as chronic blood loss due to parasitic invasions and diseases of the gastrointestinal tract [12]. However, increasing iron intake alone is not enough for effective prevention and correction of IDA. New significant risk factors include features of the traditional diet, infectious diseases, genetic predisposition, inflammatory processes, metabolic disorders, intestinal dysbiosis, and socio-economic conditions. Iron deficiency is associated with a number of adverse health effects, including pregnancy complications, decreased cognitive abilities, decreased physical performance, and the development of anemia [13].

Purpose: Providing students with comprehensive knowledge about iron deficiency anemia, including its causes, risk factors, clinical manifestations, prevention methods and principles of diagnosis and treatment, as well as to develop the skills of rational nutrition and responsible attitude to their own health in order to reduce the prevalence of IDA among students.

Methods and techniques: The study used methods such as an analysis of scientific literature and a questionnaire survey (test diagnosis) conducted among 110 students of FSU in order to determine the prevalence of iron deficiency anemia and identify risk factors that can contribute to nutritional deficiencies, as well as stunted growth and development in this age group.

The questionnaire, designed to obtain demographic and socio-economic data on the study participants, included the following items:

– gender;

– the presence of a feeling of weakness and increased fatigue;

– the appearance of tinnitus;

– episodes of fainting;

– the presence of the following clinical manifestations (pallor of the skin, dryness of the skin, brittle hair, concavity and loss of shine of nails, cracks in the corners of the mouth, tooth decay, tingling and "creeping goosebumps" on the body, perversion of taste sensations);

– the regularity of breakfast intake (regular or irregular);

– types of foods consumed (fruits, vegetables, meat, fish and chicken), classified as: not consumed, rarely (less than two servings per week) and often (more than two servings per week);

– tea consumption: in the absence, during or after meals, as well as frequent consumption (more than four times a day);

– the presence of a smoking habit, defined as "yes" or "no".

Results: The results showed that the prevalence of iron deficiency anemia was 70% among the surveyed students, of which 64% were women and 36% were men, and also reflected the adverse effects of anemia in this age group. In women, the most common causes of anemia are heavy menstrual blood loss, increased iron demand during pregnancy, as well as disorders of iron absorption, transport, and deposition, including hemoglobinopathies [14,15]. Iron metabolism disorders are a clear example of conditions in which fatigue is the leading clinical manifestation, detected in 72% of students with IDA. The exact pathophysiological

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mechanisms of fatigue development in iron deficiency have not been fully established. A number of authors, using experimental models on mice, have demonstrated that iron deficiency predominantly affects the maximum oxygen consumption by tissues [16]. A decrease in the ability of tissues, especially muscle, to absorb oxygen with iron deficiency can lead to an increase in the load on the cardiovascular system and, as a result, to the development of fatigue. 89% of the students had clinical manifestations characteristic of anemia and sideropenic syndromes. In the course of the analysis of this study, a significant relationship was established between IDA and the nutritional characteristics of students, including breakfast intake, drink consumption, as well as the frequency of consumption of meat, vegetables and fruits during the week at the university stage of study. It was revealed that students who regularly had breakfast (35%) or frequently consumed fruits and vegetables (48%), as well as red meat (45%) during the week, had more favorable iron levels compared to those who ate breakfast irregularly or consumed insufficient amounts of fruits and meat products. Indeed, a higher prevalence of IDA was observed among students who took breakfast irregularly (36%), skipped it completely (29%) or rarely ate vegetables and fruits (52%), as well as those who did not eat meat (15%) or consumed it rarely (40%). In addition, a significant prevalence of IDA was observed among students who regularly drank tea — more than four times a day (47%) or immediately after meals (54%). Many studies have found that smoking is associated with a higher prevalence of iron deficiency anemia [17]. Although smoking cigarettes can lead to an increase in hemoglobin and hematocrit levels, which is probably due to exposure to carbon monoxide, which reduces oxygen stress and causes hypoxia of the body [18]. In response to hypoxia, erythropoiesis in the hematopoiesis organs increases, which leads to an increase in the concentration of hemoglobin and hematocrit, while the level of serum ferritin may remain reduced [19]. However, the effect of smoking on other indicators of iron metabolism remains poorly understood [18]. In this study, it was found that 23% of students without anemia were smokers, while this figure was 6% among students with IDA.

Conclusions: To date, iron deficiency anemia continues to be the most common form of micronutrient deficiency in developing countries and is a consequence of a long-term negative iron balance in the body. Most cases of IDA are due to insufficient inclusion of healthy iron-rich foods in the daily diet, regular tea consumption and irregular breakfast intake, which have been identified as significant risk factors contributing to the high prevalence of IDA among university students. In order to reduce the prevalence of iron deficiency anemia among students, it is necessary to conduct adequate sanitary and educational training aimed at raising awareness about anemia and its etiological factors, the benefits of eating foods with a high iron content, as well as avoiding unhealthy foods and beverages. Patients should undergo a comprehensive examination to identify the causes of anemia in order to choose the most effective treatment strategy. Clinical management includes eliminating the underlying cause of absolute or functional iron deficiency, if possible, as well as replenishing its deficiency with oral or intravenous medications. Currently, approaches to the treatment of IDA are increasingly shifting towards intravenous therapy, as it allows for faster recovery of iron reserves and is accompanied by fewer side effects compared with oral administration [20].

The appointment of iron preparations is usually necessary to restore iron homeostasis and should be determined by the severity of anemia, the presence of concomitant pathology, the level of red blood cells, serum iron levels and morphological characteristics of red blood cells. The same indicators are used to monitor further demand for iron supplements. Additional iron administration is effective in the treatment of iron deficiency anemia, but is not recommended

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for other forms of anemia and in some cases may be harmful due to the risk of iron overload [21].

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