

## MODERN LABORATORY DIAGNOSIS OF FOLIC ACID DEFICIENCY ANEMIA

*Najmiddinova Nigora Kamoliddinovna, Uzokov Sirooidin Sultonovich*

*Dusyorova Sokinabonu Aburazzoq kizi*

*Najmiddinova Nigora Kamoliddinovna - assistant at the Department of  
Clinical Laboratory Diagnostics*

*Uzokov Sirooidin Sultonovich - Samarkand branch of the Republican  
Scientific Center of Emergency Medicine gastroenterologist*

*Dusyorova Sokinabonu Aburazzoq kizi- cadet at the Department of Clinical  
Laboratory Diagnostics*

*Samarkand State*

*Medical University*

*Republic of Uzbekistan, Samarkand*

**Abstract:** Folic acid in the context of anemia deficiency is becoming an increasingly important topic in modern healthcare. Folic acid, being a water-soluble B vitamin, plays a key role in DNK synthesis and the formation of red blood cells. Deficiency of this vitamin leads to impaired performance of red blood cells, which, in turn, causes the development of megaloblastic anemia. Folic acid is especially important during pregnancy, as it is necessary for the development of the brain and spinal cord of babies. Getting enough folic acid during pregnancy can help prevent birth defects such as neural tube defects. Therefore, it is recommended that women planning pregnancy and pregnant women receive sufficient amounts of folic acid.

**Key words:** folic acid, DNK, anemia, diagnosis, laboratory, erythropoiesis, differential diagnosis.

## СОВРЕМЕННАЯ ЛАБОРАТОРНАЯ ДИАГНОСТИКА ФОЛИЕВО- КИСЛОТОДЕФИЦИТНОЙ АНЕМИИ

*Нажмиддинова Нигора Камолитдиновна,*

*Узоков Сирожиддин Султонович,*

*Дусёрова Сокинабону Абдураззок кизи*

*Нажмиддинова Нигора Камолитдиновна - ассистент кафедре  
клинической лабораторной диагностики*

*Узоков Сирожиддин Султонович - Самаркандский филиал*

*Республиканского научного центра скорой медицинской помощи врач  
гастроэнтеролог*

*Дусёрова Сокинабону Абдураззок кизи – курсант кафедре клинической лабораторной диагностики Самаркандский государственный медицинский университет Республика Узбекистон, г. Самарканд*

**Аннотация:** фолиевой кислоты в контексте дефицитной анемии становится всё более важной темой в современном здравоохранении. Фолиевая кислота, являясь водорастворимым витамином группы В, играет ключевую роль в синтезе ДНК и формировании эритроцитов. Дефицит этого витамина приводит к нарушению производительности красных кровяных клеток, что, в свою очередь, вызывает развитие мегалобластной анемии. Фолиевая кислота особенно важна во время беременности, так как она необходима для развития головного и спинного мозга малышей. Получение достаточного количества фолиевой кислоты во время беременности может помочь предотвратить врожденные дефекты, такие как дефекты нервной трубки. Поэтому женщинам, планирующим беременность, и беременным женщинам рекомендуется получать достаточное количество фолиевой кислоты.

**Ключевые слова:** фолиевой кислоты, ДНК, анемия, диагностика, лаборатория, эритропоез, дифференциальная диагностика.

Every year, the number of studies revealing a link between folic acid deficiency and various diseases, including cardiovascular pathologies and neurological disorders, increases. Inadequate folate intake may be associated with poor nutrition, increased stress and other factors, which emphasizes the need for careful monitoring of the level of this vitamin in the body.

Families in which replenishment is expected should especially monitor their diet, since the consumption of folic acid is critically important for the proper development of the fetus. Therefore, awareness of the importance of folic acid in the prevention of anemia deficiency and maintenance of general health should be a priority for both physicians and the public.

pathogenesis Folic acid deficiency anemia is a condition resulting from folate deficiency in the body, which leads to disruption of normal ДНК synthesis and, consequently, to the formation of improperly formed or immature red blood cells. The main pathogenesis of this disease is a violation of cell division and an increase in cell volume, which is manifested by macrocytosis — an increase in the size of red blood cells.

Folic acid deficiency can be caused by various factors, including insufficient intake in the diet, impaired absorption in the intestine, as well as increased body needs, for example, during pregnancy or in the presence of chronic diseases. In addition, some

medications may inhibit folate synthesis. Clinical manifestations of anemia may include fatigue, weakness, dizziness, and tachycardia. Laboratory tests usually show low hemoglobin levels and thinning of blood cells. Treatment consists in replenishing folate, which helps to improve symptoms and correct hematopoiesis. In addition, it is important to identify and eliminate the causes of deficiency in order to prevent relapses.

Laboratory diagnostics Laboratory diagnostics of folic acid and anemia deficiency is an important aspect of the modern medical approach to the identification and treatment of various forms of anemia. Folic acid, or vitamin B9, plays a key role in the process of hematopoiesis, participating in DNK synthesis and the formation of red blood cells. Its deficiency can lead to megaloblastic anemia, characterized by an increase in the size of red blood cells and their low functionality [10,14,17].

Various laboratory methods are used to diagnose folic acid deficiency. One of the main ones is to determine the level of folic acid and niacin, as well as to assess the level of homocysteine. An increased level of homocysteine may indicate a deficiency of the vitamin, since its metabolism depends on folic acid. An important step is also the analysis of megalocyte cells and markers of B12 deficiency.

Timely detection of folic acid deficiency makes it possible to prescribe adequate therapy, including vitamin intake and dietary changes, which helps to improve the condition of patients and their full-fledged life. Folic acid, also known as vitamin B9, plays a key role in the formation and development of cells, especially in the process of hematopoiesis. A deficiency of this important acid can lead to anemia, a condition in which the level of hemoglobin in the blood decreases, which leads to insufficient oxygen supply to tissues. As a result, the patient may feel tired, weak, as well as various neurological disorders.

The causes of folic acid deficiency are diverse, it can be both insufficient intake of vitamin c from food, and violations of its absorption in the body, for example, in certain diseases of the gastrointestinal tract. Pregnant women are especially at risk, as the need for folic acid increases during this period.

Diagnosis of anemia caused by folic acid deficiency requires a blood test. Treatment usually involves prescribing folic acid medications and correcting the diet of liver, leafy vegetables, legumes and citrus fruits. Early attention to symptoms and adequate therapy will help to avoid serious complications and restore the patient's energy and vitality levels. Folic acid, or vitamin B9, plays a key role in the blood formation process, especially in DNK synthesis and cell division. Folic acid deficiency can lead to macrocytic anemia, which is characterized by the formation of large and ineffective red blood cells, which in turn causes fatigue, weakness and a number of other unpleasant symptoms. Laboratory diagnostics includes tests for hemoglobin levels, hematocrit, as well as determination of folate levels in blood serum and red blood cells.

Treatment of deficiency anemia associated with a lack of folic acid usually consists in the appointment of vitamin preparations. It is also important to adjust the diet by enriching it with folate-rich foods such as green leafy vegetables, legumes, citrus fruits and cereals.

Prevention of folic acid deficiency includes regular consumption of such products, especially for women of reproductive age, since vitamin deficiency is important during pregnancy to prevent malformations in the fetus. A conscious approach to nutrition and regular preventive examinations will help to avoid the negative effects of anemia. [1, 5, 9, 10,].

The clinical picture shows common signs resulting from tissue hypoxia: pallor, tachycardia, shortness of breath, poor appetite, lethargy or increased excitability. Since with folic acid deficiency anemia, ineffective erythropoiesis occurs in the bone marrow and due to this increased destruction of hemoglobin-containing cells, the level of indirect bilirubin increases in the blood and mild jaundice of the sclera and skin appears. In severe forms, there may be a slight enlargement of the spleen (reactive hyperplasia). Thus, there is some similarity in the symptoms of folic acid deficiency anemia and hemolytic anemia. Laboratory examination allows for reliable differential diagnosis of these forms of anemia. According to laboratory signs, folic acid deficiency anemia almost coincides with B12 deficiency anemia. The differences are in the different levels of vitamin B12 and folic acid in the blood. In addition, folic acid deficiency anemia, unlike B12 deficiency anemia, is not characterized by signs of damage to the nervous system. It should be remembered that isolated vitamin B12 deficiency in childhood is rare and is usually a complication of helminthic invasion by a broad tapeworm or hereditary metabolic disorders. Folic acid deficiency anemia is extremely rare in its pure form. As a rule, folic acid deficiency is combined with iron deficiency, since these conditions develop due to the action of uniform etiopathogenetic factors. At the same time, both clinical manifestations and laboratory characteristics of anemia depend on the ratio of the severity of iron and folate deficiency. Given that in IDA and folic acid deficiency anemia, there are multidirectional shifts in iron metabolism and erythrocyte indices, laboratory tests with mixed anemia become uninformative. In this situation, the anamnesis and clinic of anemia are crucial. It should be noted that in case of combined deficiency, the administration of folic acid without iron preparations will lead to incomplete hemoglobin recovery and to the manifestation of clinical and laboratory signs of iron deficiency. Conversely, if you start treatment with iron preparations, signs of folic acid deficiency will appear. Laboratory diagnostics Folic acid deficiency anemia is characterized by: 1 hyperchromia, macrocytosis 2 low reticulocyte count 3 high serum iron levels 4 high ferritin levels 5 moderate increase in indirect bilirubin 6 low folic acid levels (norm more than 3 ng/ml) 7 normal vitamin B12 levels in the blood 8 picture

of megaloblastic hematopoiesis in the bone marrow. When iron and folic acid deficiency are combined, combinations of laboratory signs may be observed, which leads to an uncertain picture and difficulty in diagnosis; in this case, it is necessary to focus on clinical symptoms and anamnesis. [3, 6, 11, 12,16,18].

Folic acid, also known as vitamin B9, plays a key role in the formation of red blood cells and DNK synthesis. A deficiency of this important substance can lead to folate deficiency anemia, a condition in which the body cannot produce enough healthy red blood cells. The main causes of folic acid deficiency include insufficient intake from food, increased body needs, for example, during pregnancy, or problems with absorption in the intestine. Symptoms of anemia can range from fatigue and weakness to dizziness and shortness of breath. It is important to note that folic acid is especially important during periods of rapid growth, including childhood and pregnancy, when the intake of this vitamin should be increased.

Folic acid, or vitamin B9, plays a key role in DNK synthesis and the formation of red blood cells. Deficiency of this important vitamin can lead to deficiency anemia, a condition characterized by a decrease in hemoglobin levels and a decrease in the number of red blood cells in the blood. In the body, folic acid promotes normal cell division, especially in the bone marrow, where blood formation occurs. With a lack of folate, there is a decrease in the production of healthy red blood cells, which exacerbates the symptoms of anemia, such as fatigue, weakness, pale skin and difficulty concentrating. Cells formed in conditions of deficiency can also have abnormally large size — macrocytes, which is a characteristic sign of macrocytic anemia. [2, 5, 9, 10,14,17].

Prevention and treatment of folic deficiency anemia includes dietary adjustments, the addition of foods rich in folic acid, such as green leafy vegetables, legumes and citrus fruits. In addition, in some cases, it is recommended to take supplements under the supervision of a doctor. Maintaining a normal level of folic acid in the body contributes not only to the prevention of anemia, but also to the overall improvement of health. Prevention of folic acid and anemia deficiency is an important task that requires attention from both medical professionals and patients themselves. Folic acid, or vitamin B9, plays a key role in the production of red blood cells, and its deficiency can lead to the development of anemia, characterized by fatigue, weakness and dysfunction of various organs.

For effective prevention, it is necessary to include foods rich in folic acid in the diet, such as green leafy vegetables, beans, nuts and whole grains. In addition, folic acid supplements may be recommended for women of reproductive age, pregnant and lactating women, as their need for this vitamin increases.

Regular medical examinations and blood tests also contribute to the timely detection of deficiency and prevention of its consequences. It is important to remember

that the prevention of deficiency anemia is a complex process that includes a balanced diet, a healthy lifestyle and giving up bad habits. Prevention plays a fundamental role in maintaining overall health and well-being, allowing you to avoid serious complications in the future. [1, 4, 9, 10,14,17].

Conclusions. Laboratory tests, including blood tests for hemoglobin levels, red blood cell count and folate content, are important for the diagnosis of folic acid deficiency. Regular consumption of foods rich in folic acid, such as green leafy vegetables, legumes and citrus fruits, can prevent the development of deficiency anemia and maintain the health of the body as a whole.

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