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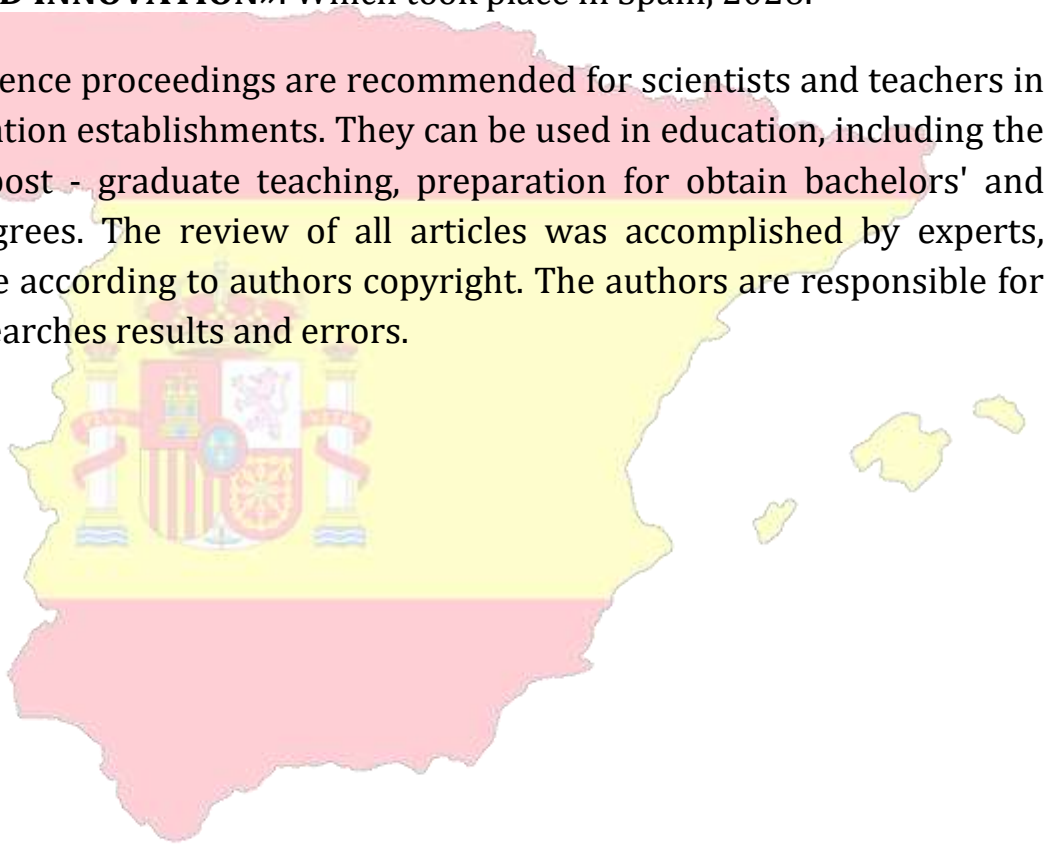

Iron deficiency anemia in children: etiology, clinical signs, and prevention

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Annotation. This article highlights the relevance of iron deficiency anemia in children, the causes of its occurrence, and its impact on children's health. Iron deficiency anemia is one of the most common hematological diseases in pediatric practice and has a negative effect on the physical and mental development of children. The article analyzes the main etiological factors, clinical signs, as well as the importance of early detection and prevention of iron deficiency anemia. In addition, the possibilities of improving children's health through the prevention of this disease are considered.

Keywords: Iron deficiency anemia, Children, Hemoglobin, Etiology, Clinical signs, Diagnosis, Treatment, Prevention, Pediatric nutrition, Microcytic anemia

Introduction. In recent years, the increase in cases of anemia among children has become one of the important problems in the field of pediatrics. In particular, iron deficiency anemia is widespread among young children and has a significantly negative impact on the processes of growth and development of the organism. Iron is an important microelement for the body, playing a crucial role in hemoglobin synthesis, oxygen delivery to tissues, and the functioning of the immune system.

The high demand for iron in children, improper nutrition, frequent infectious diseases, and social factors may contribute to the development of iron deficiency anemia. If this disease is not detected in time, complications such as delayed psychomotor development, attention and memory disorders, and rapid fatigue may be observed in the child. Therefore, special attention to the issues of early diagnosis, treatment, and prevention of iron deficiency anemia in children is of great importance.

Etiology. Iron deficiency anemia in children develops as a result of an imbalance between iron intake, absorption, and the body's increased physiological needs. One of the main etiological factors is insufficient dietary iron intake, especially in infants and young children who do not receive adequate iron-rich complementary foods. Prolonged exclusive breastfeeding without timely introduction of iron-containing foods may also contribute to iron deficiency.

Another important cause is impaired iron absorption, which may occur due to gastrointestinal disorders, chronic diarrhea, or malabsorption syndromes. Increased iron requirements during periods of rapid growth, such as infancy and adolescence, play a significant role in the development of iron deficiency anemia. Additionally, chronic blood loss caused by parasitic infections, gastrointestinal bleeding, or frequent blood sampling can lead to depletion of iron stores.

Socioeconomic factors, including poor living conditions, low parental awareness, and limited access to balanced nutrition, further increase the risk of iron deficiency anemia in children. Frequent infectious diseases may also aggravate iron

deficiency by affecting iron metabolism and reducing appetite, thereby contributing to the development of anemia.

Pathogenesis. Iron deficiency anemia develops gradually due to depletion of iron stores in the body. Initially, iron reserves in the liver, spleen, and bone marrow decrease, which does not immediately affect hemoglobin levels. As iron deficiency progresses, hemoglobin synthesis is impaired, leading to microcytic and hypochromic erythrocytes. Reduced hemoglobin results in decreased oxygen delivery to tissues, which causes fatigue, pallor, and impaired physical development in children.

In addition, iron deficiency affects the functioning of various enzymes and neurotransmitters, contributing to neurological symptoms such as attention deficit, irritability, and delayed psychomotor development. The pathogenesis of iron deficiency anemia is multifactorial, involving inadequate dietary intake, increased physiological requirements, chronic blood loss, and malabsorption.

Clinical Signs. Iron deficiency anemia in children manifests with three main syndromes:

Anemic syndrome: dizziness, rapid fatigue, drowsiness, pallor.

Sideropenic syndrome: hair loss, brittle nails, cracks at the corners of the lips, changes in taste perception (craving for chalk or soil).

Neurological signs: decreased attention, difficulty in studying, irritability.

Several laboratory and clinical examinations are used to diagnose iron deficiency anemia:

Complete blood count. Hemoglobin level decreases (below 110 g/L), the number of erythrocytes decreases, and MCV (mean corpuscular volume) becomes reduced.

Biochemical tests. Serum iron and ferritin levels are decreased, while transferrin is increased.

Clinical presentation. The physician observes the above-mentioned signs in the patient and compares them with laboratory findings.

Diagnosis. The diagnosis of iron deficiency anemia in children is based on a combination of clinical evaluation and laboratory tests. Clinical assessment includes the identification of pallor, fatigue, hair loss, brittle nails, and other signs associated with anemic, sideropenic, and neurological syndromes.

Laboratory confirmation is performed through:

Complete blood count (CBC): decreased hemoglobin (<110 g/L), reduced erythrocyte count, and decreased mean corpuscular volume (MCV).
Biochemical tests: reduced serum iron and ferritin levels, increased transferrin levels, and elevated total iron-binding capacity (TIBC).
Additional tests: peripheral blood smear showing microcytic hypochromic erythrocytes, and, if needed, bone marrow iron stores evaluation.
Early diagnosis is crucial to prevent complications and ensure timely treatment and intervention.

Treatment Methods. The treatment of iron deficiency anemia requires a comprehensive approach:
Diet correction. The child's diet should include increased amounts of beef, liver, fish, eggs, and green vegetables. Vitamin C improves iron absorption, therefore lemon, orange, and red fruits are also beneficial.
Iron preparations. Oral medications (iron sulfate, iron fumarate, iron gluconate) are most commonly used. They gradually but effectively increase hemoglobin levels.
Injectable preparations (iron dextran, ferrum lek) are prescribed only in severe cases or for patients with impaired intestinal absorption.
Vitamins and minerals. Folic acid, vitamin B12, and vitamin C enhance the effectiveness of treatment.
Monitoring and prevention. Treatment lasts 3–6 months. The physician regularly monitors hemoglobin levels.

Effectiveness of Treatment
Recent clinical studies show that:
1.With properly selected iron preparations, hemoglobin levels increase by 20–30 g/L within 4–6 weeks.
2.The child's general condition improves, appetite increases, and activity rises.
3.Treatment cannot be stopped halfway because even after hemoglobin rises, the body still needs continued therapy to replenish iron stores.

Prevention
The prevention of iron deficiency anemia occupies a special place in pediatric practice:

1.Prescribing iron and folic acid to pregnant women.
2.Breastfeeding newborns for at least 6 months.
3. Balancing children's nutrition.
4. Timely treatment of infectious diseases and preventive measures against parasites.

Conclusion. Iron deficiency anemia in children remains one of the most common hematological disorders in pediatric practice, with significant implications for both physical and cognitive development. If left unrecognized or untreated, it can lead to delayed psychomotor development, decreased attention and memory, fatigue, and reduced overall activity. Early diagnosis, comprehensive treatment, and preventive measures are essential to minimize these complications and ensure optimal growth and development.

Effective management of iron deficiency anemia involves a multifaceted approach. Diet correction by including iron-rich foods such as meat, liver, fish, eggs, and green vegetables, combined with vitamin C to enhance iron absorption, forms the foundation of therapy. Oral iron supplements, and in severe cases, injectable iron preparations, provide a reliable method to restore hemoglobin levels and replenish iron stores. Additionally, the use of vitamins and minerals, including folic acid and vitamin B12, enhances the effectiveness of treatment.

Prevention plays a crucial role in reducing the prevalence of iron deficiency anemia. Maternal supplementation with iron and folic acid during pregnancy, exclusive breastfeeding for at least six months, balanced nutrition for children, and timely management of infectious diseases and parasitic infections are key strategies. Continuous monitoring of hemoglobin levels and follow-up ensures the success of both treatment and preventive measures.

In conclusion, addressing iron deficiency anemia in children requires coordinated efforts from healthcare providers, parents, and the community. Timely intervention and preventive strategies not only restore hematological parameters but also support the overall health, growth, and development of children, ultimately contributing to a healthier pediatric population.

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