

**EARLY DIAGNOSIS AND PREVENTION OF IRON DEFICIENCY ANEMIA IN
CHILDREN**

Yunusov D.M.

Assistant Department of Pediatrics and Polyclinic
Pediatrics of Children's Diseases, Andijan State Medical Institute

Abstract. Iron Deficiency Anemia (IDA) is one of the most prevalent nutritional disorders affecting children worldwide and remains a major public health concern, particularly in developing countries. It results from inadequate iron intake, impaired absorption, increased physiological demands, or chronic blood loss. Children under five years of age, infants, and adolescents are especially vulnerable due to rapid growth and increased iron requirements. Early detection of IDA is crucial, as even mild iron deficiency—before the development of anemia—can adversely affect neurocognitive development, behavior, physical growth, and immune competence. If left untreated, IDA may lead to long-term consequences, including learning difficulties, decreased academic performance, and increased susceptibility to infections. Modern approaches to early diagnosis include not only routine hematological parameters such as hemoglobin and hematocrit levels, but also more sensitive indicators like serum ferritin, transferrin saturation, and soluble transferrin receptors. Screening programs targeting high-risk groups and the use of standardized clinical guidelines have significantly improved early identification of iron deficiency states. Preventive strategies play a key role in reducing the burden of IDA. These include promotion of exclusive breastfeeding during the first six months of life, timely introduction of iron-rich complementary foods, dietary diversification, and fortification of staple foods with iron. In addition, prophylactic iron supplementation in high-risk populations, parental education, and regular pediatric monitoring are essential components of prevention. Public health interventions aimed at improving nutrition, sanitation, and access to healthcare services further contribute to lowering the incidence of IDA in children. In conclusion, early diagnosis combined with comprehensive preventive measures is essential to minimize the adverse effects of iron deficiency anemia in childhood and to ensure optimal growth, development, and overall health outcomes.

Keywords: iron deficiency anemia, children, early diagnosis, prevention, nutrition, screening, supplementation

Introduction. Iron deficiency anemia (IDA) remains one of the most widespread micronutrient deficiencies among infants and young children worldwide, with the highest prevalence observed in low- and middle-income countries. Despite significant advances in healthcare, nutrition, and public health strategies, IDA continues to be a major pediatric concern due to its high incidence and potentially serious long-term consequences. Rapid growth during infancy and early childhood significantly increases iron requirements, making this age group particularly vulnerable to iron deficiency, especially in the presence of inadequate dietary intake or unfavorable socioeconomic conditions.

The etiology of IDA in children is multifactorial and includes insufficient iron intake, low bioavailability of dietary iron, prolonged exclusive breastfeeding without appropriate iron supplementation after six months, early introduction of cow's milk, recurrent infections, and parasitic infestations. Additional contributing factors may include prematurity, low birth weight, and maternal anemia during pregnancy, all of which can lead to reduced iron stores at birth.

IDA is not only a hematological disorder but also a condition with systemic effects. It is strongly associated with delayed psychomotor development, impaired cognitive performance, reduced attention and learning capacity, and behavioral disturbances. Moreover, iron plays a

critical role in immune function; therefore, its deficiency increases susceptibility to infections and may worsen the course of common childhood illnesses. Importantly, some of these adverse effects may be irreversible if iron deficiency occurs during critical periods of brain development.

Given these significant consequences, early identification of at-risk children and timely diagnosis of iron deficiency are essential components of pediatric care. Screening strategies, risk assessment, and the use of sensitive laboratory markers enable clinicians to detect iron deficiency at pre-anemic stages. Equally important is the implementation of effective preventive measures, including nutritional counseling, promotion of breastfeeding with appropriate supplementation, use of iron-fortified foods, and targeted prophylactic iron therapy in high-risk populations.

Materials and Methods. This study is based on a comprehensive analysis of current scientific literature, international clinical guidelines, and available observational data concerning the diagnosis and prevention of iron deficiency anemia (IDA) in children. Relevant sources were identified through a review of peer-reviewed articles, systematic reviews, and recommendations from leading health organizations focusing on pediatric nutrition and hematology.

The methodological approach included the synthesis and critical evaluation of published data addressing epidemiology, risk factors, diagnostic criteria, and preventive strategies for IDA in pediatric populations. Particular attention was given to studies involving infants and young children, as these groups represent the highest risk categories.

Standard diagnostic tools for the assessment of iron deficiency and anemia were analyzed. These included measurement of hemoglobin concentration, complete blood count (CBC) parameters such as mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and red cell distribution width (RDW), as well as biochemical markers of iron metabolism. Among these, serum ferritin was considered the most informative indicator of iron stores, while additional parameters such as transferrin saturation and total iron-binding capacity were also reviewed where applicable.

Observational data from clinical practice were incorporated to illustrate common diagnostic approaches and challenges in early detection of IDA. Inclusion criteria for the analyzed materials focused on studies involving pediatric populations, publications in English within recent years, and sources providing clinically relevant data on screening, diagnosis, and prevention.

Results. The analysis of current literature and clinical data demonstrates that early diagnosis of iron deficiency anemia (IDA) in children is based on a combination of risk assessment, laboratory evaluation, and clinical observation.

Early detection primarily relies on targeted screening of high-risk groups. These include infants, particularly those aged 6–24 months, premature and low birth weight babies, as well as children with inadequate or unbalanced nutrition. Additional risk groups include children with chronic illnesses, recurrent infections, or those from socioeconomically disadvantaged backgrounds. Identification of these groups allows for timely screening and early intervention before the development of severe anemia.

Laboratory diagnostics remain the cornerstone of IDA detection. Key parameters include decreased hemoglobin and hematocrit levels, which indicate anemia, along with red blood cell indices obtained from complete blood count, such as reduced mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH). Serum ferritin is recognized as the most sensitive marker for assessing iron stores and enables detection of iron deficiency at pre-anemic stages. Additional indicators, including transferrin saturation and total iron-binding capacity, further improve diagnostic accuracy when available.

Clinical manifestations, although often nonspecific, also contribute to early recognition of IDA. Common signs observed in children include pallor of the skin and mucous membranes,

fatigue, irritability, decreased appetite, and reduced physical activity. In some cases, delays in cognitive and psychomotor development may also be noted, particularly in prolonged or untreated iron deficiency.

The findings highlight that preventive strategies play a crucial role in reducing the incidence of IDA in pediatric populations. One of the most effective measures is the promotion of exclusive breastfeeding during the first six months of life, followed by appropriate nutritional support. The timely introduction of iron-rich complementary foods—such as meat, fortified cereals, and legumes—is essential to meet the increasing iron requirements of growing children.

Iron supplementation is recommended for high-risk groups, including premature infants and children with identified iron deficiency or increased physiological needs. In addition, regular pediatric check-ups and structured screening programs significantly contribute to early detection and prevention, allowing healthcare providers to monitor growth, nutritional status, and hematological parameters over time.

Discussion. Early diagnosis of iron deficiency anemia (IDA) in children remains a significant clinical challenge, primarily due to the nonspecific and often subtle nature of its early symptoms. Manifestations such as fatigue, irritability, decreased appetite, and pallor may be mild or mistakenly attributed to other common pediatric conditions. As a result, reliance on clinical presentation alone is insufficient for timely identification, particularly in the pre-anemic stage of iron deficiency.

In this context, laboratory screening assumes a central role in the diagnostic process. The use of standardized hematological and biochemical markers, including hemoglobin levels, complete blood count indices, and serum ferritin, allows for more accurate and early detection of iron deficiency before the onset of severe anemia. Routine screening of high-risk populations has been shown to significantly improve diagnostic rates and enable earlier intervention, thereby reducing the risk of long-term complications.

Preventive measures, especially those focused on nutrition, have demonstrated high effectiveness in reducing the incidence and severity of IDA. Adequate intake of dietary iron through breastfeeding, iron-rich complementary foods, and fortified products is essential to meet the increased physiological demands during periods of rapid growth. In populations at increased risk, prophylactic iron supplementation further enhances prevention outcomes and reduces the likelihood of deficiency.

Equally important is the role of education in addressing IDA. Raising awareness among parents and caregivers about proper infant feeding practices, the importance of balanced nutrition, and early signs of iron deficiency contributes to improved prevention and timely healthcare seeking. Additionally, continuous education of healthcare providers ensures adherence to updated clinical guidelines, appropriate screening practices, and evidence-based management strategies.

Conclusion. Early diagnosis and prevention of Iron Deficiency Anemia (IDA) in children are essential for reducing its global prevalence and minimizing the risk of long-term adverse outcomes. Given the high vulnerability of infants and young children, timely identification of iron deficiency—particularly at pre-anemic stages—plays a crucial role in preventing irreversible effects on cognitive development, physical growth, and immune function.

The findings emphasize that effective management of IDA requires a comprehensive and integrated approach. This includes routine screening of high-risk groups, the use of sensitive and reliable laboratory diagnostic methods, and continuous monitoring within pediatric care settings. Equally important is the implementation of evidence-based preventive strategies, such as promotion of breastfeeding, timely introduction of iron-rich complementary foods, dietary diversification, and appropriate use of iron supplementation when indicated.

In addition, strengthening health education for parents and caregivers, along with improving awareness and adherence among healthcare professionals to current clinical guidelines, significantly enhances early detection and prevention efforts. Public health policies aimed at improving nutrition, food fortification, and access to healthcare services further contribute to reducing the burden of IDA at the population level.

References

1. World Health Organization. Iron deficiency anaemia: assessment, prevention and control. A guide for programme managers. Geneva: WHO; 2001.
2. World Health Organization. WHO guidance helps detect iron deficiency and protect brain development. 2020.
3. McDonagh M., Blazina I., Dana T., et al. Routine iron supplementation and screening for iron deficiency anemia in children aged 6–24 months: systematic review. Rockville: Agency for Healthcare Research and Quality; 2015.
4. Institute of Medicine (US). Iron Deficiency Anemia: Recommended Guidelines for Prevention, Detection, and Management. Washington (DC): National Academies Press; 1993.
5. Jullien S. Screening of iron deficiency anaemia in early childhood. BMC Pediatrics. 2021;21:337.
6. Siu A.L.; U.S. Preventive Services Task Force. Screening for iron deficiency anemia in young children: recommendation statement. Pediatrics. 2015;136(4):746–752.
7. Zimmermann M.B., Hurrell R.F. Nutritional iron deficiency. The Lancet. 2007;370(9586):511–520.
8. Mukhtarova N., Ha B., Diamond C.A., et al. Serum ferritin threshold for iron deficiency screening in one-year-old children. Journal of Pediatrics. 2022;245:217–221.