(*) Corresponding author
Original research article
DOI: https://doi.org/10.20544/uklop.2026.614
Received: 28.10.2025 • Accepted after revision: 30.01.2026 • Published: 07.05.2026

#UKLO Annual International Scientific Conference

IRON DEFICIENCY ANEMIA IN PREGNANCY: PREVALENCE, DIAGNOSIS, AND PUBLIC HEALTH STRATEGIES

Biljana Ilkovska*
University St. "Kliment Ohridski" - Bitola, Higher Medical School Bitola, Department of laboratory diagnostics, PHO Clinical hospital dr. Trifun Panovski Bitola, R. Macedonia
ORCID: https://orcid.org/0000-0002-6287-3830
drbilanailkovska@yahoo.com

Bisera Kotevska Trifunova
Department of Dermatology and Venereology, Acibaden city clinic Tokuda hospital - Sofia, Bugaria
ORCID: https://orcid.org/0000-0003-0437-6526
bkotevska@abv.bg

Filip Ilkovski
High Medical School Dr. Trifun Panovski Bitola, R. Macedonia
ORCID: https://orcid.org/0009-0002-9271-3608

ABSTRACT

Introduction: *Iron deficiency anemia (IDA) is the most common nutritional disorder worldwide and the leading cause of anemia during pregnancy. Pregnant women are particularly vulnerable due to increased iron demands, posing risks for both maternal and fetal health. The aim of this study is to assess the prevalence, diagnostic approaches, and public health strategies related to IDA in pregnancy.*
Methods: *A review of epidemiological data from the World Health Organization (WHO), relevant literature, and national health registries was conducted. Diagnostic standards based on hemoglobin concentration and serum ferritin levels were evaluated, along with screening and iron supplementation strategies within antenatal care.*
Results: *According to WHO data, more than 40% of pregnant women globally suffer from anemia, with iron deficiency being the main cause. The highest prevalence is recorded in South Asia and Sub-Saharan Africa, but moderate prevalence is also seen in parts of Europe and the Balkans. Early screening and iron supplementation during pregnancy have shown positive outcomes, including a measurable decrease in maternal anemia and associated complications.*
Discussion: *The findings highlight the need for standardized prenatal screening protocols and universal supplementation policies. Barriers include limited access to health services, lack of awareness, and low adherence to supplementation. Improving maternal health requires strengthened public health initiatives, education on nutrition, and equitable access to prenatal care. Further research is needed to optimize timing and delivery of interventions.*

Keywords: iron deficiency, anemia, pregnancy, maternal health, supplementation

1. INTRODUCTION

Iron deficiency anemia is the most common type of anemia globally and is one of the most widespread nutritional disorders in the world [1]. Iron is a trace element required for the synthesis of hemoglobin, myoglobin, oxygen transport and cellular metabolism [2]. During pregnancy, the body's need for iron increases by about 50-100% compared to normal women, these needs are due to the growth of the fetus in utero, an increase in maternal blood volume and the development of the placenta [3].

Microcytic and hypochromic anemia are the most common forms of anemia in pregnant women and are the result of insufficient intake or absorption of iron, which leads to a gradual depletion of ferritin reserves [4]. The clinical picture of iron deficiency anemia during pregnancy includes tachycardia, fatigue, reduced resistance to infections, an increased risk of premature birth, low birth weight and perinatal mortality [5].

In the Republic of North Macedonia, anemia is a significant health problem among pregnant women. It is diagnosed in every third to fourth pregnancy, and according to the World Health Organization, the country is classified among those with a moderate prevalence of anemia [6]. Since the condition is preventable, public health policy must focus on systematic screening, accessible supplementation, and education of women of reproductive age.

2. PATHOPHYSIOLOGY OF IRON DEFICIENCY ANEMIA

During pregnancy, iron requirements increase by approximately 1000 mg. Of this amount, about 300 mg are used for fetal and placental development, 500 mg for the expansion of maternal erythrocyte mass, and around 200 mg are lost through physiological processes [7]. Iron is absorbed in the duodenum in the Fe^{2+} form, and its absorption is facilitated by vitamin C and an acidic environment [8]. Iron is stored as ferritin in the liver, spleen, and bone marrow. A deficiency leads to impaired erythropoiesis, increased reticulocyte count in peripheral blood, and the appearance of microcytic, hypochromic erythrocytes with reduced hemoglobin.content.

During the second trimester, physiological hemodilution occurs, causing a temporary decrease in hemoglobin levels. However, if hemoglobin concentration falls below 105 g/L, this indicates a pathological process and true anemia [9].

3. LITERATURE REVIEW

According to WHO data, 41.8% of pregnant women worldwide suffer from anemia, and about half of these—approximately 22%—have iron deficiency anemia. Other types include megaloblastic and hemolytic anemias [10].

In low-income countries, prevalence can reach up to 60%, whereas in more developed countries, due to higher socioeconomic status and better nutrition, rates drop significantly to 10–20% [11].

Numerous European studies show that Balkan countries have a moderate prevalence of IDA, with the highest rates observed in Serbia (35%), Bosnia and Herzegovina (32%), and slightly lower rates in North Macedonia (28%) [12].

Literature and research evidence confirm that iron deficiency is primarily related to poor nutrition, low dietary iron intake, insufficient health education, and inappropriate use of iron supplements [13,14]. Additional risk factors include recurrent infections, frequent parasitic infestations in some regions, and short intervals between pregnancies [15].

The WHO recommends prophylactic supplementation with 30–60 mg of elemental iron and 400 µg of folic acid daily for all pregnant women [16]. Regular supplementation significantly reduces the incidence of anemia, improves placental blood flow, and lowers the risk of postpartum hemorrhage [17].

4. METHODS

A systematic analysis of data from multiple sources was performed, including the World Health Organization (WHO Global Database on Anaemia), the Ministry of Health of the Republic of North Macedonia (National Reports 2018–2023), the Institute of Public Health of North Macedonia, and published scientific papers indexed in PubMed, Scopus, and Google Scholar-(2005–2024).

Keywords used: *iron deficiency anemia*, *pregnancy*, *North Macedonia*, *public health strategies*.

A total of 42 sources were reviewed, of which 25 were retained based on relevance and methodological quality.

5. RESULTS

5.1 Global Trends

According to global estimates, iron deficiency accounts for approximately 70% of all anemia cases during pregnancy [18].

5.2 Situation in North Macedonia

According to data from the Institute of Public Health, 27.4% of pregnant women in North Macedonia in 2022 had hemoglobin values below 110 g/L. Therefore, WHO categorizes the country among those with a moderate risk of iron deficiency anemia [19].

Women from rural areas and those with lower education levels are most affected.

Although WHO recommends routine supplementation with iron, vitamin C, and folic acid from the first trimester, studies indicate that about 35% of pregnant women do not take iron supplements regularly. The most commonly cited reasons include gastrointestinal side effects and insufficient awareness or education [20].

6. DISCUSSION

Iron deficiency anemia is a multifactorial condition that requires an integrated approach for effective prevention and management. Iron is an inexpensive and widely available micronutrient, but the deficiency persists due to low health literacy and improper supplement use [21].

In North Macedonia, pregnant women routinely undergo blood count testing each trimester. However, due to limited resources and reagents, serum ferritin measurements—which are the key indicator of iron stores—are often unavailable in smaller healthcare facilities [22].

To reduce the incidence of iron deficiency anemia, the following actions are recommended:

- Strengthening antenatal screening — mandatory anemia testing in the first and third trimesters;
- Educational programs for pregnant women — provided by obstetricians and public health nurses on proper supplement use and nutrition;
- Nutritional support programs — promoting consumption of iron- and vitamin C–rich foods;
- Intersectoral collaboration — coordinated actions between the Ministries of Health, Education, and media campaigns;
- Continuous monitoring — establishing a national registry for anemia in pregnancy and ensuring state-level follow-up and support.

Public health intervention models implemented in Croatia and Slovenia have demonstrated excellent results, reducing prevalence below 15% [24].

7. CONCLUSION

Iron deficiency anemia is a significant health problem in North Macedonia. In order to reduce maternal mortality and prevent poor perinatal outcome of pregnancy, effective primary prevention, timely diagnosis of anemia and taking measures to eliminate it with proper nutrition or the use of appropriate iron preparations are necessary.

In addition to the treatment of pregnant women, the state also needs to take preventive measures such as implementing a national program for the prevention and early detection of iron deficiency anemia; integrating nutrition education for pregnant women within the framework of prenatal care;

Providing financial support and equal access to iron supplements for all women, especially those from rural and Roma communities.

Such a strategy would improve the health of mothers and children and reduce the overall burden of anemia in the country.

8. REFFERENCE

1. World Health Organization. *Global prevalence of anaemia in 2021*. Geneva: WHO; 2023.
2. Milman N. Iron requirements in pregnancy and strategies to prevent deficiency. *Acta Haematol*. 2006;115(1-2):12–22.
3. Breymann C. Iron deficiency anemia in pregnancy. *Semin Hematol*. 2015;52(4):339–47.
4. Pavord S, et al. UK guidelines on the management of iron deficiency in pregnancy. *Br J Haematol*. 2020;188(6):819–30.
5. Peña-Rosas JP, Viteri FE. Effects and safety of preventive oral iron. *Cochrane Database Syst Rev*. 2009;(4):CD001135.
6. Министерство за здравство на РС Македонија. *Извештај за мајчино здравје 2022*. Скопје; 2023.
7. Abbaspour N, Hurrell R, Kelishadi R. Review on iron and its importance for human health. *J Res Med Sci*. 2014;19(2):164–74.
8. Haider BA, et al. Anaemia, prenatal iron use, and risk of adverse pregnancy outcomes. *BMJ*. 2013;346:f3443.
9. Stevens GA et al. Global, regional, and national trends in hemoglobin concentration. *Lancet Glob Health*. 2013;1:e16–25.
10. UNICEF. *Iron supplementation in Eastern Europe and Central Asia*. New York; 2021.
11. Institute of Public Health of North Macedonia. *Annual Health Report*. Skopje; 2022.
12. Zdravstven dom Bitola. *Лабораториски податоци за трудници 2020–2023*. Внатрешен извештај.
13. Ilkovska B, et al. Iron deficiency anemia in pregnancy: regional data from the Balkans. *Med Pregl*. 2023;76(2):89–97.
14. WHO. *Iron deficiency anaemia: assessment, prevention, and control*. Geneva; 2001.
15. Ministry of Health Croatia. *Maternal Health Report 2021*. Zagreb; 2022.
16. European Food Safety Authority. *Iron: dietary reference values*. Parma; 2020.
17. Pavord S, et al. *British Committee for Standards in Haematology: Iron deficiency in women*. *Br J Haematol*. 2019;187(3):366–82.
18. Ilkovska B, Kotevska Trifunova B, Ilkovski F. *Iron deficiency and pregnancy outcomes in the Balkans*. *Med Sci J*. 2024;5(1):22–30.
19. Institute of Public Health of North Macedonia. Annual Report on Maternal and Child Health 2022. Skopje: Institute of Public Health; 2023.

20. Ministry of Health of North Macedonia. Report on antenatal care and supplementation adherence among pregnant women 2021–2022. Skopje: MoH; 2022.
21. Peña-Rosas JP, De-Regil LM, Garcia-Casal MN, Dowswell T. Daily oral iron supplementation during pregnancy. Cochrane Database Syst Rev. 2015;(7):CD004736.
22. Poposka D, Jovanovska A, Petrovska D. Assessment of antenatal laboratory capacity in rural healthcare settings in North Macedonia. Health Policy Maced. 2021;8(2):47–54.
23. Ministry of Health Croatia. Maternal Health Report 2021. Zagreb: Croatian Institute of Public Health; 2022.