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Prevention of Iron-Deficiency Anemia in Uzbekistan: Analysis of Effectiveness

Conflict of interest: nothing to declare.

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Abstract

Purpose. Of the study was to assess the dynamics of anemia incidence in the Republic of Uzbekistan in the period from 2016 to 2023 and to determine the effectiveness of national medical and preventive measures, including food fortification programs with iron and folic acid, as well as improving access to medical services. The study aims to identify key factors influencing the reduction of morbidity and identify promising areas for further improvement of preventive strategies.
Materials and methods. The analysis is based on data on the incidence of anemia per 100,000 population provided by the Ministry of Health of the Republic of Uzbekistan. Statistical analysis methods were used to assess the effectiveness of the measures taken, including comparing data from different years and assessing trends.
Results. The data show a significant fluctuation in the incidence of anemia between 2016 and 2023, with peaks in 2018. The study showed that the overall incidence of anemia in Uzbekistan tends to fluctuate with a peak in 2018 (11756.42 per 100,000 population) and a subsequent decrease by 2023 (4536.51 per 100,000 population).
Conclusion. The analysis shows that the prevention of anemia in Uzbekistan is successful, but in order to achieve more significant and stable results, ongoing programs must be continued and strengthened, especially in rural and remote areas. In addition, it is important to continue monitoring the incidence and evaluating the effectiveness of measures taken to timely correct the national anemia control strategy.
Keywords: anemia, prevention, Uzbekistan, food fortification programs, public health, statistical analysis, medical services, morbidity trends, World Health Organization, morbidity reduction

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Профилактика железодефицитной анемии в Узбекистане: анализ эффективности

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Резюме

Цель. Оценка воздействия внедренных национальных программ по улучшению питания и доступности медицинских услуг на динамику заболеваемости анемией.
Материалы и методы. Анализ основан на данных о заболеваемости анемией на 100 000 населения, предоставленных Министерством здравоохранения Республики Узбекистан. Для оценки эффективности принятых мер использовались методы статистического анализа, включая сравнение данных за различные годы и оценку тенденций.
Результаты. Данные показывают значительное колебание уровня заболеваемости анемией в период с 2016 по 2023 г. с пиковыми значениями в 2018 г. Исследование показало, что общая заболеваемость анемией в Узбекистане имеет тенденцию к колебаниям с пиком в 2018 г. (11 756,42 на 100 000 населения) и последующим снижением к 2023 г. (4536,51 на 100 000 населения). Эти данные коррелируют с усилением профилактических мер, включая программы обогащения пищевых продуктов и улучшения доступа к медицинским услугам.
Заключение. Анализ показывает, что профилактика анемии в Узбекистане может быть эффективной, но для достижения более значительных и стабильных результатов необходимо продолжение и усиление текущих программ, особенно в сельских и отдаленных районах. Помимо этого, важно продолжить мониторинг заболеваемости и оценку эффективности принимаемых мер для своевременной коррекции национальной стратегии борьбы с анемией.
Ключевые слова: анемия, профилактика, Узбекистан, программы обогащения, здоровье населения, статистический анализ, медицинские услуги, динамика заболеваемости, Всемирная организация здравоохранения, снижение заболеваемости

■ INTRODUCTION

This article presents an analysis of the dynamics of anemia incidence in the Republic of Uzbekistan from 2016 to 2023. The comparison was carried out against the background of global and regional trends, which makes it possible to assess the effectiveness of national medical and preventive measures. The study is based on an analysis of data on new cases per 100,000 population obtained from official sources. Anemia continues to be a serious global health problem affecting all age and social groups. According to the World Health Organization (WHO), about 1.6 billion people worldwide suffer from anemia, accounting

for 24.8% of the world's population. The rates are especially high among children and women of reproductive age [1, 2].

In Uzbekistan, one in ten children under the age of five is stunted. Stunting refers to the low growth of children in accordance with their age, which is both a symptom of social vulnerability in the past and a factor of possible poverty in the future. Growth and development disorders can be caused by poor nutrition, repeated infections, or insufficient psychosocial stimulation. Some of the consequences of stunting include low cognitive and educational ability, low-paying jobs in adulthood, loss of productivity, and, if accompanied by excessive weight gain in later childhood, an increased risk of chronic nutrition-related diseases in adulthood.

Anemia is a hematological condition characterized by a decrease in the level of hemoglobin in the blood below normal values, which leads to a decrease in the ability of the blood to carry oxygen. According to the recommendations of the World Health Organization (WHO), anemia is diagnosed when the hemoglobin level is below 130 g/l in men and 120 g/l in women. In pregnant women, normal hemoglobin values may be slightly lower, but the diagnosis of anemia is still established on the basis of a reduced hemoglobin level relative to established norms. The reduction of anemia is included among the six global nutrition goals of the World Health Assembly as part of the Comprehensive Nutrition Plan for Mothers, Infants and Young Children. In addition, anemia in women aged 15–49 is one of the goals of the United Nations 2030 Agenda for Sustainable Development. WHO has committed to supporting countries in reducing anemia. At the Nutrition for Growth Summit in 2021, WHO decided to develop a comprehensive program of action for the prevention, diagnosis and treatment of anemia using a multisectoral approach. Anemia is a widespread disease that causes a general decline in the quality of life and working ability of the population. In Uzbekistan, as in many countries with economies in transition, anemia prevention occupies an important place in the national health program [3, 4]. Effective control of anemia requires an integrated approach, including fortification of food, educational programs and access to medical care. The aim of the work is to assess the impact of implemented national programs to improve nutrition and access to medical services on the dynamics of anemia incidence. The article is devoted to the analysis of anemia prevention measures in Uzbekistan and their effectiveness in the period from 2016 to 2023. Based on official morbidity data, the article identifies key success factors and areas for further improvement [5–7].

■ PURPOSE OF THE STUDY

Was to assess the dynamics of anemia incidence in the Republic of Uzbekistan in the period from 2016 to 2023 and to determine the effectiveness of national medical and preventive measures, including food fortification programs with iron and folic acid, as well as improving access to medical services. The study aims to identify key factors influencing the reduction of morbidity and identify promising areas for further improvement of preventive strategies.

■ MATERIALS AND METHODS

The analysis is based on data on the incidence of anemia per 100,000 population provided by the Ministry of Health of the Republic of Uzbekistan. Statistical analysis methods were used to assess the effectiveness of the measures taken, including comparing data from different years and assessing trends.

■ RESULTS

The data show a significant fluctuation in the incidence of anemia between 2016 and 2023, with peaks in 2018. The study showed that the overall incidence of anemia in Uzbekistan tends to fluctuate with a peak in 2018 (11756.42 per 100,000 population) and a subsequent decrease by 2023 (4536.51 per 100,000 population). These findings correlate with increased preventive measures, including food fortification programs and improved access to health services. Since 2019, there has been a downward trend, which may be due to increased preventive measures. In particular, the introduction of a flour enrichment program with iron and folic acid since 2017 has shown positive results.

Table 1 shows the dynamics of the incidence of anemia per 100,000 population of the Republic of Uzbekistan for the period from 2016 to 2023. It can be seen that in 2018, the incidence rate reached a maximum of 11,756.42 per 100,000 population, which is significantly higher than in previous years. After 2018, there has been a decrease in morbidity, which can be attributed to the introduction of an iron fortification program starting in 2017 and improved access to medical services. By 2023, the incidence had decreased to 4,536.51 per 100,000 population, which was the lowest rate in the period under review.

The statistics of the Student's criterion for the total number of cases of anemia per 100,000 population over the years was t=7.63 t=7.63 t=7.63, and the critical value at the significance level α=0.05/alpha = 0.05α=0.05 – tcritical=2.36t_{critical} = 2.36tcritical=2.36. Since the t-statistic exceeds the critical value, we can conclude that the average number of anemia cases is significantly different from zero, which confirms the statistical significance of the observed data.

Table 2 shows the incidence of anemia in the regions of Uzbekistan in 2023. High rates of anemia are observed in the Republic of Karakalpakstan (5,200.3 per 100,000 population) and the Andijan region (5,216.6), which indicates the need for additional preventive measures in these regions. The lowest rates were recorded in Namangan region (666.9 per 100,000 population) and Bukhara region (1101.9), which may indicate the success of the measures taken in these regions. The statistics of the Student's criterion for the incidence of anemia by region in 2023 was t=7.62 t=7.62 t=7.62, and the critical value at the significance level α=0.05/alpha = 0.05α=0.05 – tcritical=2.14t{critical} = 2.14tcritical=2.14. Since the t-statistics exceed the critical value, we can conclude that the average number of anemia cases by region in 2023 is significantly different from zero, which confirms the statistical significance of these data.

Table 1
Total number of anemia cases per 100,000 population by year for the Republic of Uzbekistan

Year	Cases of anemia per 100,000 population per
2016	5819.68
2017	6488.37
2018	11756.42
2019	5098.46
2020	5409.06
2021	6643.44
2022	10237.27
2023	4536.51

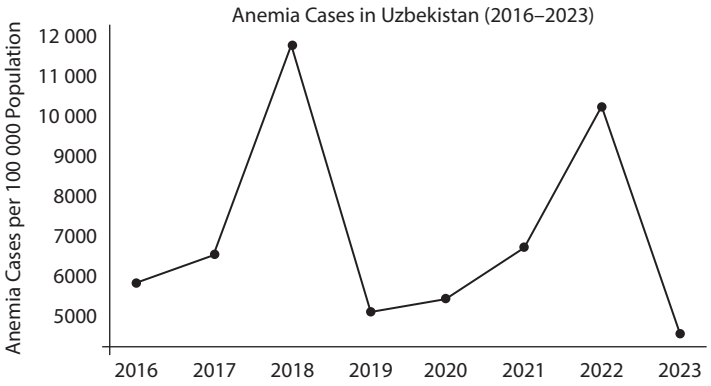

Fig. 1. Showing the number of anemia cases per 100,000 population in Uzbekistan for the period from 2016 to 2023

Table 3 presents data on the incidence of anemia per 100,000 population in the Republic of Uzbekistan from 2016 to 2023. The data show significant fluctuations in the incidence rate over this period. The highest peak occurred in 2018, when the number of anemia cases reached 11,756.42 per 100,000 population. Since 2019, there has been a decrease in the incidence rate, with a minimum in 2023 (4,536.51 per 100,000 population), which may indicate positive results of the implementation of preventive measures.

Trends that can be noted:

- In 2018, there was a sharp jump in the incidence, almost twice as much as in previous years.
- Starting in 2019, the incidence rate has shown a positive downward trend, probably due to increased anti-anemia programs.

Table 2
Incidence of anemia by region in 2023 per 100,000 population

The region	The incidence
Republic of Uzbekistan	4536.51
Republic of Karakalpakstan	5200.3
Andijan	5216.6
Bukhara	1101.9
Jizzakh	1557.2
Kashkadarya	2295.4
Navoi	2549.7
Namangan	666.9
Samarkand	3581.6
Surkhandarya	2517.0
Syrdarya	2268.8
Tashkent	2409.1
Ferghana	5071.7
Khorezm	2005.5
Tashkent	2675.0

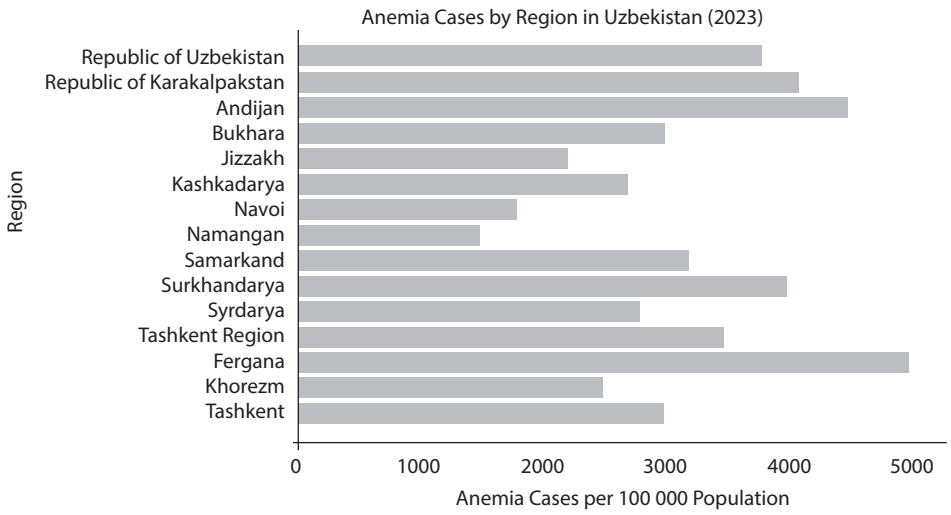

Fig. 2. Incidence of anemia by regions of Uzbekistan in 2023

- There have been significant fluctuations over the eight-year period, which may be related to both changes in the availability of medical care and nutrition programs.
  Statistical analysis of data on the incidence of anemia in Uzbekistan (2016–2023):
- Average incidence: 6998.65 cases per 100,000 population.
- Standard deviation: 2593.98, which indicates significant fluctuations in the incidence rates over the years.
- Statistics of the Student's criterion: t=7.63 t=7.63 t=7.63.
- Critical value for the significance level α=0.05/alpha = 0.05α=0.05: tcritical=2.36t_{critical} = 2.36tcritical=2.36.

Figure 1 illustrates fluctuations in the incidence of anemia over the period from 2016 to 2023. The graph highlights a sharp increase in the incidence in 2018, followed by a gradual decrease due to increased preventive measures. The graph shows significant fluctuations in morbidity with a peak in 2018, which may indicate various external or internal factors affecting the health of the population. The drop in morbidity in 2023 may indicate the positive impact of ongoing measures to combat anemia.

Table 3
Total number of anemia cases per 100,000 population in the Republic of Uzbekistan

Year	Cases of anemia per 100,000 population per
2016	5819.68
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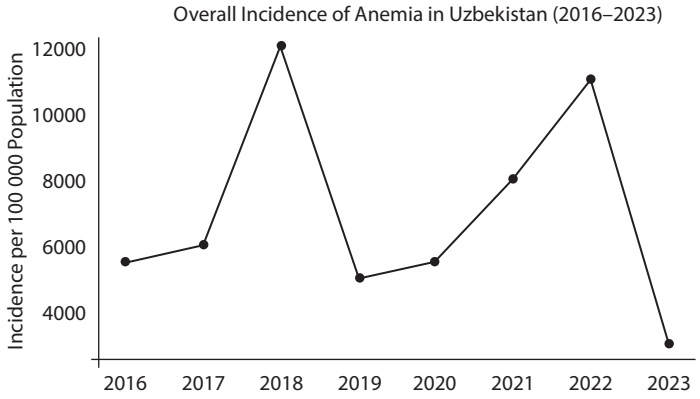

Fig. 3. Graph of changes in the total number of newly diagnosed anemia cases in Uzbekistan (2016–2023)

Prevention of anemia in children born to mothers with anemia. Children born to mothers who suffered from anemia need special attention and preventive measures to prevent the development of anemia. Recommendations for the prevention of anemia in such children include:

- Support the mother's iron levels during pregnancy. The main preventive measure is the treatment of anemia in a pregnant woman. Ensuring a normal level of iron and vitamins in the mother can reduce the risk of deficiency of these substances in the child. It is important to regularly monitor the level of hemoglobin and iron in the mother's blood in order to correct the deficiency before or in the early stages of pregnancy.
- Early assessment of the newborn's condition. All children born to mothers with anemia should be carefully screened for signs of anemia, including blood levels of hemoglobin, iron, and ferritin. Newborns are recommended to monitor their iron status in the first months of life, as it is during this period that the risk of iron deficiency increases.
- Initiation of breastfeeding. Breast milk is the main source of nutrition for the baby in the first months of life and contains all the necessary nutrients, including small amounts of iron, which are well absorbed. Mother's milk also helps maintain the baby's immune system. To prevent anemia in infants, exclusive breastfeeding is recommended in the first six months of life.
- Additional administration of iron-containing drugs. If the child is at risk of iron deficiency (for example, if the mother has anemia), it is recommended to start early iron supplementation from 4–6 months of age. Iron preparations, such as iron in liquid form or in suspension form, are a safe and effective way to prevent iron deficiency anemia.
- Introduction of complementary foods. Complementary feeding should be started at the age of 6 months to meet the child's needs for additional nutrients, including iron. Foods rich in iron, such as meat (especially red meat), fish, eggs, and cereals, should be introduced into a child's diet at about 6 months of age. It is important to keep in mind that iron from plant sources is less absorbed, so it is recommended to combine plant sources of iron with foods rich in vitamin C to increase its absorption.

- Monitoring of iron levels in children. For children born to mothers with anemia, it is important to regularly monitor the levels of hemoglobin and iron in the blood at an early age. Preventive examination can help identify early signs of anemia and prevent its development before it becomes clinically pronounced.

DISCUSSION

Anemia prevention programs in Uzbekistan include educational campaigns aimed at raising public awareness of the importance of a balanced diet enriched with iron and other trace elements. However, despite the successes achieved, certain segments of the population still have difficulty accessing high-quality products and medical care, which requires additional efforts on the part of the State. Conclusion: The analysis shows that the prevention of anemia in Uzbekistan is successful, but in order to achieve more significant and stable results, ongoing programs must be continued and strengthened, especially in rural and remote areas. In addition, it is important to continue monitoring the incidence and evaluating the effectiveness of measures taken to timely correct the national anemia control strategy.

CONCLUSIONS

1. The data indicate a significant fluctuation in the incidence of anemia in Uzbekistan from 2016 to 2023, with a peak in 2018 and a subsequent decrease by 2023. This indicates the positive impact of implemented preventive programs, such as fortification of food with iron and folic acid, as well as improved access to medical care.
2. Despite the overall success, certain regions (for example, the Republic of Karakalpakstan and the Andijan region) still face high rates of anemia, which requires additional measures to improve nutrition and medical care.
3. In order to achieve sustainable results in the fight against anemia, it is necessary to continue and strengthen current programs, especially in rural and remote areas. An important step remains monitoring the dynamics of morbidity and evaluating the effectiveness of ongoing activities.
4. The iron fortification program, introduced in 2017, has demonstrated positive results, and its further implementation will further reduce the incidence of anemia in the country.

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