

HIDDEN IRON DEFICIENCY PREVENTION IN PRESCHOOL CHILDREN IN THE BUKHARA REGION

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Abstract: Iron deficiency, including its latent form, is a critical health concern that affects the physical and mental development of preschool children. This study assesses the prevalence of hidden iron deficiency (HID) among children aged 3–6 in the Bukhara region and evaluates the effectiveness of preventive interventions. Using a mixed-method approach, data from 250 children were analyzed based on hematological markers, dietary patterns, and socioeconomic conditions. Preventive strategies, including dietary modifications, iron supplementation, and parental education, were implemented. Results showed a significant improvement in iron levels and a 28% reduction in HID prevalence after six months. This study highlights the importance of early detection and integrated interventions for managing HID in pediatric populations.

Keywords: Hidden iron deficiency, pediatric nutrition, prevention strategies, Bukhara region, child development

Introduction. Iron deficiency is a pervasive global issue, particularly in low- and middle-income countries, where dietary limitations and poor access to healthcare exacerbate the problem. In Uzbekistan, the prevalence of iron deficiency in children under five remains alarmingly high, often undiagnosed until clinical symptoms appear. Hidden iron deficiency (HID), a subclinical form of iron depletion, is associated with significant developmental and cognitive impairments.

This study investigates:

1. The prevalence of HID among preschool-aged children in the Bukhara region.
2. The socioeconomic and dietary risk factors contributing to HID.
3. The effectiveness of community-based prevention strategies in reducing HID rates.

Materials and Methods. Study Design

This study was conducted as a cross-sectional analysis combined with an interventional phase in 2024. Ethical approval was obtained from the Bukhara State Medical Institute Ethics Committee.

Participants

Sample Size: 250 preschool children (3–6 years) from 10 urban and rural kindergartens in the Bukhara region.

Inclusion Criteria: No clinical symptoms of anemia, no chronic diseases, and parental consent.

Exclusion Criteria: Children with diagnosed anemia or other chronic illnesses.

Data Collection Tools

1. **Hematological Analysis:** Blood samples were analyzed for hemoglobin, serum ferritin, transferrin saturation, and C-reactive protein (CRP).
2. **Dietary Surveys:** Parents provided detailed reports on their children's weekly dietary intake, focusing on iron-rich and iron-inhibiting foods.
3. **Socioeconomic Assessments:** Family income, parental education, and living conditions were documented.

Interventional Measures

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1. Nutritional Counseling: Educational workshops for parents emphasized the importance of iron-rich diets, including animal proteins, legumes, and fortified foods.
2. Iron Supplementation: Low-dose iron drops were administered to children with low ferritin levels for six months.
3. Community Support: Collaboration with local health departments introduced fortified meals in kindergarten programs.

Statistical Analysis

Data were analyzed using SPSS version 25. Continuous variables were expressed as means \pm standard deviations, and categorical variables were expressed as percentages. Pre- and post-intervention differences were assessed using paired t-tests and chi-square tests.

Results: Prevalence of Hidden Iron Deficiency

Overall Prevalence: 37% of children exhibited serum ferritin levels below 15 $\mu\text{g/L}$, indicating HID.

Demographic Disparities: Rural children were more affected than urban peers (45% vs. 29%). Boys showed a slightly higher prevalence than girls (40% vs. 34%).

Risk Factors. 1. Dietary Deficiencies: 68% of children consumed inadequate iron, with diets dominated by plant-based and iron-inhibiting foods (e.g., tea, dairy).

2. Infections: Children with recurrent respiratory or gastrointestinal infections were more prone to HID.

3. Socioeconomic Barriers: Families with lower income and education levels had limited access to iron-rich foods and supplements.

Impact of Interventions

Biochemical Improvements: Serum ferritin levels increased significantly ($p < 0.001$).

Hemoglobin levels remained within the normal range, indicating effective HID management.

Reduction in HID Prevalence: The overall prevalence decreased from 37% to 9% after six months of interventions.

Parental Feedback: 82% of parents reported improved dietary habits.

74% observed better physical activity levels in their children.

Discussion: The findings confirm that HID is a silent but significant burden among preschool children in the Bukhara region. Dietary deficiencies, compounded by socioeconomic challenges, are the primary contributors. The success of the implemented interventions emphasizes the importance of integrated approaches, combining nutritional education, supplementation, and policy-level support.

Policy Implications. 1. Routine screening for HID in pediatric healthcare settings.

2. Government-subsidized iron-fortified food programs targeting low-income families. 3. Community awareness campaigns to promote balanced diets and iron-rich food consumption.

Limitations. 1. Short follow-up period for assessing long-term sustainability of interventions. 2.

Limited generalizability to other regions with different dietary and socioeconomic profiles.

Conclusion: This study highlights the high prevalence of hidden iron deficiency among preschool children in the Bukhara region and demonstrates the effectiveness of targeted preventive measures. Early diagnosis and intervention through community-based strategies can significantly improve child health outcomes. Future research should focus on long-term impacts and scalability of these interventions.

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