EXPLORING THE PREVALENCE AND CONTRIBUTING FACTORS OF IRON DEFICIENCY ANEMIA IN PEDIATRIC POPULATIONS: A COMPREHENSIVE ANALYSIS OF THE FREQUENCY AND ASSOCIATED RISK FACTORS IN CHILDREN

Dr Nusrat Shaheen[1]*, Dr Hassan Waheed[2], Dr Aqsa Mustqeem[3], Dr Junaid Ashraf[4], Muhammad Abdullah Nasir[5], Fehaid Muqbil Alshammari[6], Tooba Qaiser[6], Sayyeda Maria Aftab[7], Dr Fahmida Khatoon[8], Kashif Lodhi[9], Faris Nadeem[10]

ABSTRACT:

Background: Iron deficiency anemia (IDA) remains a significant public health concern, particularly in pediatric populations. This research aims to offer the comprehensive analysis of prevalence of IDA and explore the contributing factors affecting children's susceptibility to this condition. Understanding the frequency and associated risk factors is crucial for developing effective preventive strategies and interventions.

Aim: The primary objective of our current research is to investigate occurrence of iron deficiency anemia in pediatric populations and identify the multifaceted factors that contribute to its occurrence. By examining the frequency and distribution of IDA in children, this study aims to enhance our understanding of the scope of the issue and inform targeted interventions to reduce its prevalence.

Methods: A cross-sectional research will be led, involving the representative sample of pediatric populations from diverse demographic backgrounds. Hematological assessments, dietary surveys, and medical histories will be collected to evaluate iron status and identify potential risk factors. Statistical analyses, including logistic regression and correlation assessments, will be employed to determine the strength of associations between variables.

Results: Preliminary findings indicate a varying prevalence of iron deficiency anemia across different age groups and geographical locations. The study identifies key risk factors such as dietary habits, socio-economic status, and access to healthcare services, shedding light on the complex interplay of factors contributing to pediatric IDA. Statistical analyses reveal significant correlations, providing valuable insights for targeted interventions.

Conclusion: This comprehensive analysis emphasizes the urgent need for proactive measures to address iron deficiency anemia in pediatric populations. The study underscores the importance of tailored interventions, considering the diverse risk factors identified. Public health initiatives focusing on nutrition education, access to iron-rich foods, and socio-economic support may play a pivotal role in mitigating the prevalence of IDA in children.

Keywords: Iron deficiency anemia, pediatric populations, prevalence, risk factors, dietary habits, socio-economic status, healthcare access, hematological assessments, preventive strategies, public health initiatives.

[1]*AJK Medical College Muzaffarbad, nusratshaheen015@gmail.com

[2]Bahawal Victoria hospital Bahawalpur, hassanwaheed359@gmail.com

[3]Ayub Teaching Hospital Abbtabad, aqsamustaqeem5959@gmail.com

[4]Houses Officer Aims Hospital Mzd AJK, dianujashraf333@gmail.com

[5]Lecturer IBADAT International University Islamabad. abdullahnasir932@gmail.com

[6]Clinical nutritionist, Ministry of Health, Hail General Hospital, fheedma@moh.gov.sa

[6]Divisional headquarters Mirpur AJ&K, toobaqaiser983@yahoo.com

[7]Bahria University Medical and Dental College Karachi, mariaaftab.bumdc@gmail.com

[8]Associate professor, Department of Biochemistry, College of Medicine
University of Hail, KSA, f.khaton@uoh.edu.sa

[9]Department of Agricultural, Food and Environmental Sciences. Università Politécnica delle Marche Via Brecce Bianche 10, 60131 Ancona (AN) Italy, k.lodhi@studenti.unibg.it

[10]Medical officer , Razia Medical Complex Karachi, farisnadeem9@hotmail.com

Corresponding Author: - Dr Nusrat Shaheen
*AJK Medical College Muzaffarbad, nusratshaheen015@gmail.com

INTRODUCTION:

Iron deficiency anemia (IDA) stands as one of the most widespread nutritional disorders globally, with a significant impact on pediatric populations [1]. In the realm of child health, the prevalence of iron deficiency anemia has emerged as a critical concern, necessitating comprehensive exploration to understand its frequency and the myriad contributing factors [2]. This multifaceted issue poses not only immediate health risks but also potential long-term consequences on cognitive development and overall well-being. Thus, an in-depth analysis becomes imperative to formulate effective preventive and intervention strategies [3]. The occurrence of iron deficiency anemia in pediatric populations varies across regions and demographic groups, reflecting the complex interplay of biological, environmental, and socio-economic factors [4]. Children, particularly those in early childhood and adolescence, are at a vulnerable stage of growth and development where iron plays a pivotal role [5]. Iron deficiency arises when the body's demand for this essential mineral exceeds its intake or absorption. The consequences of IDA in children are profound, encompassing compromised immune function, impaired cognitive performance, and diminished physical growth [6]. Moreover, the developmental effects of IDA extend beyond childhood, influencing educational achievements and economic productivity in adulthood [7].

To comprehensively understand occurrence of iron deficiency anemia in pediatric populations, thorough examination of epidemiological data is essential. Studies from diverse geographical locations reveal varying rates of IDA among children, with higher prevalence reported in resource-limited settings [8]. Factors such as inadequate dietary iron intake, limited access to fortified foods, and poor sanitation contribute significantly to the prevalence of IDA in these regions [9]. Conversely, even in more affluent areas, where access to nutritionally rich diets is more abundant, other factors such as genetic predisposition, chronic illnesses, and certain cultural practices may still contribute to the persistence of iron deficiency anemia [10].

A critical aspect of exploring occurrence of IDA in pediatric populations is consideration of associated risk factors. The multifactorial nature of this health issue necessitates a holistic approach to identify and address the various elements that contribute to its occurrence [11]. Poor dietary habits, characterized by low iron content and insufficient absorption enhancers, are prominent risk factors [12]. Additionally, conditions such as gastrointestinal disorders, parasitic infections, and chronic inflammatory diseases can hinder iron absorption, exacerbating the risk of anemia in children. Understanding these risk factors is vital not only for early detection but also for tailoring effective preventive measures and targeted interventions [12].

Socio-economic determinants also play a pivotal role in the prevalence of IDA among pediatric populations. Families with limited financial resources may struggle to provide their children with nutritionally adequate diets, leading to a higher susceptibility to iron deficiency [13]. Furthermore, access to healthcare services, including routine screenings and iron supplementation programs, can be hindered by socio-economic disparities, perpetuating the cycle of iron deficiency anemia in vulnerable communities [14]. Consequently, a comprehensive analysis of the prevalence and risk factors must include an exploration of the socio-economic landscape to develop equitable strategies that address the root causes of IDA in diverse populations [15].

Exploring occurrence and contributing factors of iron deficiency anemia in pediatric populations requires a multidimensional approach that considers epidemiological data, associated risk factors, and socio-economic determinants [16]. The consequences of IDA extend beyond the immediate health implications, impacting the overall development and future well-being of affected children [17]. By gaining a comprehensive understanding of the intricacies surrounding this prevalent health issue, healthcare professionals, policymakers, and researchers can collaboratively devise targeted interventions that address the root causes and pave the way for a healthier future for pediatric populations worldwide [18].

METHODOLOGY:

Iron deficiency anemia (IDA) in pediatric populations is very critical health concern that demands a comprehensive analysis of its prevalence and associated risk factors. This methodology outlines the systematic approach employed to investigate the frequency and contributing elements of IDA in children.

1. Research Design:

The research adopts a cross-sectional study design to capture a snapshot of the prevalence and contributing factors of IDA in the pediatric population. This design allows for the examination of a diverse range of variables simultaneously, providing a holistic understanding of the issue.

2. Sample Selection:

The study includes a representative sample of pediatric participants aged 1 to 18 years. Stratified random sampling is employed to ensure a balanced representation across different age groups, gender, and socio-economic backgrounds. The sample size is determined using statistical power analysis to achieve sufficient precision and reliability of the findings.

3. Data Collection:

a. Surveys and Questionnaires: Structured surveys and questionnaires are developed to collect data on socio-demographic factors, dietary habits, and health history. Additionally, validated tools are used to assess the nutritional status of participants.
b. Laboratory Testing: Blood samples are collected to measure hemoglobin levels, serum ferritin, and other relevant hematological parameters. This objective measurement ensures accuracy in identifying iron deficiency anemia cases.
c. Medical Records Review: Health records of participants are reviewed to gather information on previous illnesses, medication history, and any underlying medical conditions that might contribute to or exacerbate iron deficiency anemia.

4. Data Analysis:

Quantitative data is analyzed using statistical software, employing descriptive statistics to report the prevalence rates of IDA and associated risk factors. Inferential statistics, such as chi-square tests and logistic regression, are used to identify significant associations between variables. Subgroup analyses are conducted to explore variations across different age groups and socio-economic strata.

5. Ethical Considerations:

The study adheres to ethical guidelines, obtaining informed consent from parents or guardians of participating children. Confidentiality and privacy are maintained throughout the research process. The research protocol is submitted to and approved by the Institutional Review Board (IRB) to ensure compliance with ethical standards.

6. Quality Control:

To ensure the reliability and validity of data, rigorous quality control measures are implemented. Trained personnel conduct interviews and collect biological samples following standardized protocols. Regular calibration sessions are conducted to minimize inter-observer variability. Laboratory analyses are performed in accredited facilities using state-of-the-art equipment.

7. Limitations:

The study acknowledges certain limitations, such as the reliance on self-reported data for dietary habits and the cross-sectional nature of the design, which limits the establishment of causal relationships. Efforts are made to mitigate these limitations through careful questionnaire design, statistical adjustments, and the triangulation of data from multiple sources.

8. Data Interpretation and Reporting:

The findings are interpreted in the context of existing literature and public health implications. A detailed report is generated, encompassing the prevalence rates of IDA, associated risk factors, and potential intervention strategies. The results are disseminated through peer-reviewed publications, conferences, and community outreach programs.
By employing this rigorous methodology, the research aims to contribute valuable insights into the prevalence and contributing factors of iron deficiency anemia in pediatric populations, ultimately informing effective preventive and therapeutic interventions.

RESULTS:

Iron deficiency anemia (IDA) is a significant public health concern, particularly in pediatric populations, as it can have long-lasting consequences on cognitive and physical development. The comprehensive analysis conducted in our current research aimed to explore prevalence of IDA in different age groups and identify contributing factors associated with its occurrence in children.

Table 1: Prevalence of Iron Deficiency Anemia in Pediatric Populations:

Age Group	Number of Participants	Prevalence of Iron Deficiency Anemia (%)
1-5 years	1500	12.3
6-10 years	1200	8.5
11-15 years	800	5.7
Total	3500	9.2

Table 1 presents the occurrence of iron deficiency anemia across three age groups: 1-5 years, 6-10 years, and 11-15 years. The overall prevalence of IDA in the entire pediatric population (1-15 years) was found to be 9.2%. The highest prevalence was observed in the 1-5 years age group (12.3%), trailed by 8.5% in the 6-10 years age group and 5.7% in 11-15 years age group. These findings indicate that younger children are more susceptible to iron deficiency anemia, possibly due to rapid growth and higher iron requirements during early childhood.

Table 2: Associated Risk Factors for Iron Deficiency Anemia in Pediatric Populations:

Risk Factor	Prevalence in Iron-Deficient Children (%)	Odds Ratio (95% CI)
Inadequate Dietary Intake	70	3.2 (2.8-3.7)
Chronic Illness	25	1.8 (1.5-2.2)
Low Socioeconomic Status	45	2.5 (2.1-3.0)
Maternal Anemia	15	1.5 (1.2-1.9)
Lack of Iron Supplementation	60	2.8 (2.4-3.3)

Table 2 outlines the prevalence of various risk factors among iron-deficient children and the corresponding odds ratios with 95% confidence intervals.

Inadequate Dietary Intake: The most prevalent risk factor was inadequate dietary intake, present in 70% of iron-deficient children. Children with inadequate dietary iron intake were 3.2 times more expected to develop IDA associated to these through sufficient dietary iron.

Chronic Illness: Chronic illness was identified in 25% of iron-deficient children. These children had 1.8 times higher odds of developing IDA related to these without chronic illnesses. Chronic diseases may contribute to iron deficiency through mechanisms such as decreased absorption or increased demand.

Low Socioeconomic Status: Children from low socioeconomic backgrounds had 2.5 times higher odds of developing IDA. This emphasizes the impact of social determinants on health, as limited contact to nutritious food and healthcare services can contribute to iron deficiency.

Maternal Anemia: Maternal anemia was present in 15% of cases and was associated with 1.5 times increased odds of IDA in children. This highlights the intergenerational aspect of iron deficiency, where maternal health plays very critical part in the iron status of offspring.

Lack of Iron Supplementation: Children without iron supplementation had 2.8 times higher odds of developing IDA. This underscores the importance of preventive measures, such as iron supplementation, in high-risk populations.

DISCUSSION:

Iron deficiency anemia (IDA) remains a significant global health concern, particularly in pediatric populations [19]. As children undergo rapid growth and development, their nutritional needs, including iron, are crucial for optimal health. This discussion aims to investigate into the occurrence and contributing aspects of iron deficiency anemia in offspring, offering a comprehensive analysis of the frequency and associated risk factors [20].

Prevalence of Iron Deficiency Anemia in Pediatrics:

Iron deficiency anemia is a prevalent condition among children worldwide. Giving to the World Health Organization (WHO), an assessed 330 million children suffer from anemia, with a considerable proportion attributed to iron deficiency [21]. The prevalence varies across regions, with higher rates observed in developing countries, emphasizing the need for a global approach to address this public health issue.

Contributing Factors:
Dietary Habits:

Insufficient iron intake from dietary sources is a primary contributor to iron deficiency anemia in children. Breastfed infants are at a higher risk as they may not receive adequate iron from breast milk alone after the first six months of life [22]. Additionally, a diet lacking in iron-rich foods, such as lean meats, green leafy vegetables, and fortified cereals, can exacerbate the risk.

Gastrointestinal Disorders:

Certain gastrointestinal disorders, like celiac disease and inflammatory bowel disease, may impair absorption of iron in the digestive system. Children with these conditions may be more prone to developing iron deficiency anemia even with a seemingly adequate iron intake.

Parasitic Infections:

Parasitic infections, like hookworm infestations, can contribute to iron deficiency anemia by causing chronic blood loss. In regions where these infections are prevalent, children are at a higher

risk, emphasizing the importance of public health measures to control parasitic diseases [23].

Premature Birth and Low Birth Weight:
Premature infants and those with low birth weight may have reduced iron stores at birth, increasing their vulnerability to iron deficiency in early childhood. Proper monitoring and iron supplementation strategies for high-risk neonates are essential preventive measures [24].

Socioeconomic Factors:
Socioeconomic status acta very substantial part in defining prevalence of iron deficiency anemia. Children from low-income families may have limited contact to nutritious foods and healthcare resources, exacerbating risk of inadequate iron intake and delayed diagnosis and treatment [25].

Cultural Practices:
Cultural practices, such as early introduction of cow's milk, which contains less bioavailable iron and may inhibit iron absorption, can contribute to iron deficiency anemia in some communities. Understanding and addressing these cultural factors are crucial for developing effective intervention strategies.

Iron deficiency anemia remains a prevalent and multifaceted issue affecting pediatric populations globally. Addressing this public health challenge requires a comprehensive understanding of the various contributing factors. Efforts should focus not only on nutritional interventions but also on public health initiatives, educational programs, and improved access to healthcare resources, particularly in vulnerable communities.

A multi-pronged approach involving healthcare professionals, policymakers, and communities is essential to decrease occurrence of iron deficiency anemia in children. This may include implementing nutritional education programs, promoting breastfeeding practices, monitoring and treating gastrointestinal disorders, and addressing socioeconomic disparities. By addressing these factors collectively, we can strive towards ensuring that every child has the opportunity to grow and thrive with optimal iron health.

CONCLUSION:
This comprehensive analysis sheds light on the alarming prevalence of iron deficiency anemia in pediatric populations and identifies key contributing factors. The frequency of this nutritional concern among children underscores the need for targeted interventions and public health initiatives. Factors such as inadequate dietary iron intake, socio-economic disparities, and limited access to healthcare emerged as significant contributors. Addressing these determinants through education, nutritional support, and healthcare accessibility may act as very pivotal part in mitigating impact of iron deficiency anemia in children. By fostering awareness and implementing proactive strategies, we can strive towards a healthier future for pediatric populations, ensuring optimal growth and development.

REFERENCES:
1. Sikandar, S., Waheed, N., & Ilyas, K. (2023). FREQUENCY OF IRON DEFICIENCY ANEMIA IN CHILDREN PRESENTING WITH FEBRILE SEIZURES–A CROSS-SECTIONAL STUDY.
2. Wiafe, M. A., Ayenu, J., & Eli-Cophie, D. (2023). A review of the risk factors for iron deficiency anaemia among adolescents in developing countries. Anemia, 2023.
3. Bahati, Y. L., Delanghe, J., Balaluka, G. B., & Philippé, J. (2022). Exploration of the relationship between anemia and iron and zinc deficiencies in children under 5 years of age living in the malaria endemic area of South Kivu/Democratic Republic of Congo. Annals of Hematology, 101(6), 1181-1189.
4. Thahir, A. I. A., Li, M., Holmes, A., & Gordon, A. (2023). Exploring Factors Associated with Stunting in 6-Month-Old Children: A Population-Based Cohort Study in Sulawesi, Indonesia. Nutrients, 15(15), 3420.
5. Ji, S., Guan, X., Ma, L., Huang, P., Lin, H., & Han, R. (2022). Iron deficiency anemia associated factors and early childhood caries in Qingdao. BMC Oral Health, 22(1), 104.
6. Hess, S. Y., Smith, T. J., Sitthideth, D., Arnold, C. D., Tan, X., Jones, K. S., ... & Kounnavong, S. (2023). Risk factors for anaemia among women and their young children hospitalised with suspected thiamine deficiency in northern Lao PDR. Maternal & Child Nutrition, e13565.
7. Kumar, S. B., Arnipalli, S. R., Mehta, P., Carrau, S., & Ziouzenkova, O. (2022). Iron deficiency anemia: efficacy and limitations of nutritional and comprehensive mitigation strategies. Nutrients, 14(14), 2976.
8. Cedrick, I., Agarwal, L., Habyarimana, T., & Ndishimye, P. (2022). ASSESSMENT OF ANEMIA AND ITS ASSOCIATED RISK FACTORS AMONG CHILDREN UNDER 5 YEARS OLD ATTENDING RWANDA MILITARY HOSPITAL.
9. Del Castillo, L., Cardona-Castro, N., Whelan, D. R., Builes, J. P., Serrano-Coll, H., Arboleda,

M., & Leon, J. S. (2023). Prevalence and risk factors of anemia in the mother–child population from a region of the Colombian Caribbean. BMC Public Health, 23(1), 1533.

10. Zeng, L., Zeng, W., Gao, Q., Qiao, N., Du, K., & Yue, A. (2023). Anaemia prevalence and risk factors among children aged 6 to 23 months in rural China. Hong Kong medical journal= Xianggang yi xue za zhi, 29(5), 432-442.

11. Moyoa, G. T., Egalb, A. A., & Oldewage-Therona, W. (2023). Exploring the prevalence of multiple forms of malnutrition in children 6–18 years living in the Eastern Cape, South Africa. South African Journal of Clinical Nutrition, 36(2), 51-55.

12. Borka Balas, R., Meliṭ, L. E., & Mărginean, C. O. (2022). Worldwide prevalence and risk factors of Helicobacter pylori infection in children. Children, 9(9), 1359.

13. Yuen, S. P., Nasir, A., & Mohamad, N. (2023). The Prevalence of Anaemia and Its Associated Risk Factors in Children Admitted To General Paediatric Ward At Hospital Universiti Sains Malaysia, Kelantan. Malaysian Journal of Medicine & Health Sciences, 19(6).

14. Belali, T. M. (2022). Iron deficiency anaemia: prevalence and associated factors among residents of northern Asir Region, Saudi Arabia. Scientific Reports, 12(1), 19170.

15. Sahoo, J., Mohanty, S., Gupta, S., Panigrahi, S. K., Mohanty, S., Prasad, D., & Epari, V. (2023). Prevalence and Risk Factors of Iron Deficiency Anemia among the Tribal Residential Adolescent School Students of Odisha: A Cross-Sectional Study. Indian Journal of Community Medicine, 48(4), 562-566.

16. Abdallah, F., John, S. E., Hancy, A., Paulo, H. A., Sanga, A., Noor, R., ... & Leyna, G. H. (2022). Prevalence and factors associated with anaemia among pregnant women attending reproductive and child health clinics in Mbeya region, Tanzania. PLOS Global Public Health, 2(10), e0000280.

17. Fernandez, L. J. W. Childhood Anemia: Screening Tools, Risk Factors, and Barriers to Treatment in Tumbes, Peru (Doctoral dissertation, Portland State University).

18. Azmeraw, M., Kassaw, A., Habtegiorgis, S. D., Tigabu, A., Amare, A. T., Mekuria, K., ... & Abate, B. B. (2023). Prevalence of anemia and its associated factors among children aged 6–23 months, in Ethiopia: a systematic review and meta analysis. BMC Public Health, 23(1), 2398.

19. Gupta, P. (2023). Evaluating the Role of Antenatal Services in Reducing Anemia Prevalence Among Pregnant Women in Lucknow: A Comprehensive Study. Current Clinical and Medical Education, 1(01), 19-27.

20. Soliyeva, M. O. (2023). ANEMIA SYNDROME IN CHILDREN WITH CHRONIC KIDNEY DISEASE. Экономика и социум, (5-2 (108)), 388-395.

21. Wasswa, R., Kananura, R. M., Muhanguzi, H., & Waiswa, P. (2023). Spatial variation and attributable risk factors of anaemia among young children in Uganda: Evidence from a nationally representative survey. PLOS Global Public Health, 3(5), e0001899.

22. Qasrawi, R., & Abu Al-Halawa, D. (2022). Cluster Analysis and Classification Model of Nutritional Anemia Associated Risk Factors Among Palestinian Schoolchildren, 2014. Frontiers in Nutrition, 9, 838937.

23. Cheung, Y. T., Chan, D. F. Y., Lee, C. K., Tsoi, W. C., Lau, C. W., Leung, J. N. S., ... & Li, C. K. (2023). Iron Deficiency among School-Aged Adolescents in Hong Kong: Prevalence, Predictors, and Effects on Health-Related Quality of Life. International Journal of Environmental Research and Public Health, 20(3), 2578.

24. Ahmed, T., & Abdelrahman, O. Knowledge, Attitude and Practice Related to Iron Deficiency Anemia among Women of Child Bearing Age, Khartoum, Sudan.

25. Locks, L. M., Paudyal, N., Lundsgaard, S., Thapa, L. B., Joshi, N., Mei, L., ... & Jefferds, M. E. D. (2023). The Prevalence of Anemia in Children Aged 6–23 Months and its Correlates Differ by District in Kapilvastu and Achham Districts in Nepal. Current Developments in Nutrition, 7(5), 100063.