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Original Research Article

Assessing the Impact of Maternal Dietary Awareness on Iron Deficiency Anemia in Children Aged 6 Months to 2 Years

Deepak Kumar[1], Manazir Hasan Rahmani[2], Ashok Kumar[3], K.N. Mishra[4]

[1]Senior Resident, Department of Pediatrics, Darbhanga Medical College, and Hospital, Laheriasarai, Darbhanga, Bihar, India

[2]Senior Resident, Department of Pediatrics, Darbhanga Medical College, and Hospital, Laheriasarai, Darbhanga, Bihar, India

[3]Professor, Department of Pediatrics, Darbhanga Medical College, and Hospital, Laheriasarai, Darbhanga, Bihar, India

[4]Professor, Department of Pediatrics, Darbhanga Medical College, and Hospital, Laheriasarai, Darbhanga, Bihar, India

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Corresponding Author: Dr. Manazir Hasan Rahmani
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Abstract

Aim: This study seeks to examine the risk factors and the crucial function of mothers in mitigating nutritional anemia during early childhood.

Methodology: A retrospective study, conducted at Darbhanga Medical College and Hospital in Bihar, India, involved 74 children aged 6 months to 2 years. The inclusion criteria included children hospitalized during the research period, but those with chronic diseases were excluded. Data were gathered using a standardized questionnaire that encompassed demographics, medical history, nutritional status, and mother knowledge of anemia. Blood samples were examined to distinguish iron deficiency anemia from other forms of anemia.

Results: Demographic analysis indicated an equitable gender distribution, with 59.5% of participants aged 13 to 24 months. A notable percentage (24.3%) exhibited chronic malnutrition, while just 8.1% had received previous iron supplementation. Laboratory results revealed a mean hemoglobin concentration of 9.1 ± 1.5 g/dL, demonstrating a significant incidence of iron deficiency anemia (IDA). Maternal awareness was significantly elevated, with 78.4% identifying IDA; however, understanding of risk factors and symptoms was comparatively deficient.

Discussion: The findings highlight the need for improved maternal education on anemia, emphasizing risk factors and dietary patterns, as well as the execution of specific nutritional treatments to mitigate the significant impact of iron deficiency anemia in early children.

Keywords: Anemia, Childhood Malnutrition, Iron Deficiency Anemia (IDA), Maternal Awareness, Nutritional Status

Introduction

Anemia is the most prevalent nutritional deficiency condition worldwide, impacting a quarter of the global population, particularly children and women of reproductive age, hence becoming a significant public health issue [1]. It impacts 25% of the global population [2]. Despite the complex nature of anemia, iron deficiency anemia (IDA) constitutes the primary cause at 42% [3]. Children affected exhibit vague symptoms; hence, a larger percentage goes undetected till a health issue arises [4]. The World Health Organization defines anemia in pregnancy as hemoglobin levels below 11 gm/dl [5]. Iron deficiency anemia is the most prevalent nutritional issue globally [6], constituting over 50% of cases worldwide, and is responsible for 75% of anemia instances during pregnancy [7]. It also negatively impacts newborn outcomes such as fetal anemia, stillbirth, and low and very low birth weight (LBW) [8,9]. Maternal nutritional deficit during gestation impacts fetal growth, consequently affecting the newborn's birth weight [10]. The fetus is significantly reliant on mother nutritional intake, since malnutrition during pregnancy results in several negative birth outcomes, such as low birth weight (LBW). During gestation, low reserves or insufficient consumption of vital nutrients can adversely affect both moms and newborns [11-13]. Anemia prevention strategies include iron

supplementation, regular deworming, management and prevention of parasitic infections during pregnancy through consistent use of insecticide-treated bed nets, consumption of iron-rich foods, nutritional counselling to avoid coffee, tea, or milk with meals, access to clean and sufficient water, and addressing underlying causes and complications [14]. Normal pregnancy elevates the iron requirement by 2 to 3 times and the folate requirement by 10 to 20 times [15,16]. The Centers for Disease Control and Prevention advocate for anemia screening in pregnant women and universal iron supplementation to fulfil the iron demands of pregnancy [17]. The WHO advises that all pregnant women take daily iron supplements of 60mg together with a tablet containing 400µg of folic acid [18]. Compliance with anemia preventive techniques is crucial for the prevention and treatment of anemia in pregnant women, since their iron requirements escalate owing to physiological demands. Understanding anemia and implementing effective preventative strategies are essential for decreasing its incidence [19]. The objective was to examine the risk factors and the crucial role of mothers in preventing nutritional anemia throughout early childhood.

Methodology

Study Area

A retrospective study was conducted at the Department of Pediatrics at Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India for one year

Sample size

The entire sample size comprised 74 patients in this research.

Inclusion & Exclusion Criteria

This research included children aged 6 months to 2 years who were hospitalized throughout the specified study period. Participants were chosen according to their age and admission status, guaranteeing representation of the target population for our study. We eliminated children with chronic conditions, including hemoglobinopathies and hemolytic anemia, as well as those who had undergone therapy for anemia before admission. Furthermore, children receiving immunosuppressive therapies, such as steroids and biologics, were removed to reduce the potential confounding effects linked to anemia of chronic illness. The selection approach was to facilitate a more precise evaluation of iron deficiency anemia within the research population.

Procedure

This research encompassed 74 patients aged 6 months to 2 years, hospitalized and used a two-page questionnaire consisting of six questions filled out by their mothers. The initial segment gathered demographic information, socioeconomic position, and familial history, and the subsequent section concentrated on the pertinent medical histories of both the mother and child. The third portion evaluated the child's dietary history, while the fourth and fifth sections detailed the clinical presentation and investigation, respectively. The last component assessed mother understanding regarding anemia, encompassing risk factors and the significance of therapy. Height and weight were measured with standardized equipment, and nutritional status was evaluated according to WHO recommendations, omitting severely malnourished children. Socioeconomic status was classified using the Modified Kuppuswamy scale, and family structure was categorized as nuclear or joint. Blood samples were examined for complete blood counts and red blood cell indices to distinguish between iron deficiency anemia (IDA) and thalassemia. The questionnaire underwent validation by a team of specialists and was piloted with 50 moms for refining purposes. Of the 559 parents addressed, 445 completed the questionnaire, while 28 opted out and 86 were eliminated owing to inadequate replies; the analysis identified 18 children with chronic malnutrition, 11 with a history of anemia, and 6 who had previously received iron prophylaxis.

Statistical Analysis

The study was conducted using SPSS software, especially version 27. The Chi-square test was utilized for categorical data. Results indicating a P-value below 0.05 demonstrate that the outcome is statistically significant.

Results

Table 1 outlines the demographic features of the 74 research participants, suggesting that 59.5% are aged 13-24 months, whereas 40.5% are 6-12 months old, signifying a greater prevalence of older babies. The gender distribution is quite equitable, with 54.1% males and 45.9% females. Socioeconomically, around 48.6% of people identify as middle class, 37.8% as lower class, and only 13.5% as upper class, indicating a varied background that may influence healthcare access and nutrition. Furthermore, 67.6% of families are nuclear, while 32.4% consist of mixed family structures, underscoring the prevalence of smaller family units. The demographic profile may affect the health and nutritional status of the children examined.

Table 1: Demographic Characteristics of Study Participants		
Characteristic	**Frequency (n = 74)**	**Percentage (%)**
Age (months)		
6-12	30	40.5
13-24	44	59.5
Gender		
Male	40	54.1
Female	34	45.9
Socioeconomic Status (Kuppuswamy)		
Upper Class	10	13.5
Middle Class	36	48.6
Lower Class	28	37.8
Family Structure		
Nuclear	50	67.6
Joint	24	32.4

Table 2 indicates the medical history of the 74 individuals, suggesting that 14.9% have a history of anemia, whilst 24.3% are diagnosed with chronic malnutrition, signifying a notable incidence of nutritional concerns within this cohort. Only 8.1% indicated prior iron supplementation, indicating restricted availability or compliance with preventative strategies for iron insufficiency. Significantly, there were no instances of hemoglobinopathies, hemolytic anemia, or immunosuppressive medication among the individuals, underscoring a cohort mostly impacted by dietary deficiencies rather than fundamental hematological conditions. This medical history underscores the necessity for tailored measures to combat anemia and malnutrition in this population.

Table 2: Medical History of Participants		
Medical History	**Frequency (n = 74)**	**Percentage (%)**
History of Anemia	11	14.9
Chronic Malnutrition	18	24.3
Previous Iron Supplementation	6	8.1
Hemoglobinopathies	0	0
Hemolytic Anemia	0	0
Immunosuppressive Therapy	0	0

Table 3 displays the nutritional evaluation of the 74 participants, suggesting that 54.1% are categorized as well-nourished, signifying that a majority of the youngsters had acceptable nutritional status. A significant percentage demonstrates differing levels of malnutrition, with 21.6% moderately malnourished and 18.9% severely malnourished. Furthermore, 5.4% of the children are classified as suffering from chronic malnutrition. This distribution highlights substantial dietary problems within the cohort, indicating a necessity for focused nutritional interventions and assistance to enhance the health outcomes of these children.

Table 3: Nutritional Assessment		
Nutritional Status	**Frequency (n = 74)**	**Percentage (%)**
Well-nourished	40	54.1
Moderately malnourished	16	21.6
Severely malnourished	14	18.9
Chronic Malnutrition	4	5.4

Table 4 demonstrates maternal knowledge of anemia among the participants, revealing a significant degree of awareness of iron deficiency anemia (IDA), with 78.4% of mothers acknowledging the illness. Awareness of risk factors is rather low, with 60.8% recognizing contributors to anemia, whereas comprehension of its symptoms is significant at 67.6%. Significantly, 87.8% of mothers acknowledge the necessity of therapy, underscoring a robust awareness of the need for intervention. These data indicate that although many mothers recognize IDA and its treatment, there is a necessity for further education about the related risk factors and symptoms to enhance maternal understanding and promote child health.

Table 4: Maternal Awareness of Anemia		
Awareness Parameter	**Frequency (n = 74)**	**Percentage (%)**
Awareness of IDA	58	78.4
Knowledge of Risk Factors	45	60.8
Understanding Symptoms	50	67.6
Importance of Treatment	65	87.8

Table 5 displays the laboratory results of the research subjects, indicating alarming findings suggestive of iron deficiency anemia (IDA). The average hemoglobin level is 9.1 ± 1.5 g/dL, markedly behind the recommended reference range of 11.0 - 14.0 g/dL. The mean red blood cell (RBC) count of 4.2 ± 0.8 million cells/µL is at the lower limit of the reference range, warranting caution. Furthermore, mean readings for mean corpuscular volume (MCV) at 70.2 ± 5.0 fL and mean corpuscular hemoglobin (MCH) at 22.5 ± 3.0 pg are both below their respective reference ranges of 80 - 100 fL and 27 - 32 pg, indicating microcytic and hypochromic erythrocytes. The mean corpuscular hemoglobin concentration (MCHC) of 30.0 ± 1.5 g/dL is below the normal range of 32 - 36 g/dL. These data collectively corroborate a prevalence of anemia and indicate that the children in this research are having notable hematological abnormalities consistent with iron deficiency anemia (IDA).

Table 5: Laboratory Findings		
Laboratory Parameter	**Mean ± SD**	**Reference Range**
Hemoglobin (g/dL)	9.1 ± 1.5	11.0 - 14.0
RBC Count (million cells/µL)	4.2 ± 0.8	4.0 - 5.5
MCV (fL)	70.2 ± 5.0	80 - 100
MCH (pg)	22.5 ± 3.0	27 - 32
MCHC (g/dL)	30.0 ± 1.5	32 - 36

Discussion

The demographic analysis indicated that 59.5% of participants were aged 13 to 24 months, implying a greater prevalence of older babies potentially shifting to more intricate nutritional requirements. The gender distribution was very equitable, consistent with prevailing demographic patterns. Significantly, the socioeconomic status revealed that approximately fifty percent of the children originated from middle-class homes, with a considerable percentage hailing from poorer socioeconomic backgrounds. This variability indicates differing access to treatment and nutrition, which are essential for mitigating nutritional inadequacies such as iron deficiency anemia (IDA). Patton (2024) underscores the significant frequency of nutritional anemia in children, specifically emphasizing the difficulties encountered by individuals from lower socioeconomic backgrounds [20]. Their findings indicate that socioeconomic position substantially affects food choices and access to healthcare, which are essential in tackling conditions such as iron deficiency anemia (IDA).

Furthermore, Pandit (2021) presents data indicating that age correlates with susceptibility to anemia, demonstrating that children between 6 months and 5 years display elevated rates of dietary inadequacies [21]. Their research underscores the significance of dietary changes in early childhood, emphasizing the necessity for suitable nutritional treatments throughout crucial development phases. This corresponds with Lodebo's (2018) findings, which highlight the heightened dietary needs throughout early childhood and emphasize the impact of demographic shifts on nutritional health outcomes [22].

The medical history data indicated a troubling prevalence of anemia (14.9%) and chronic malnutrition (24.3%), highlighting substantial nutritional difficulties among the community. The low prevalence of prior iron supplementation (8.1%) indicates possible deficiencies in healthcare accessibility or compliance with preventative strategies. The lack of hemoglobinopathies and other hematological illnesses underscores that the challenges encountered by these youngsters are predominantly nutritional rather than attributable to chronic conditions. Chaudhary et al. (2022) highlights the association between malnutrition and anemia in children, revealing that a significant proportion of cases stem from inadequate dietary habits and insufficient knowledge about iron-rich foods [23]. This study highlights the imperative for improved maternal education on nutrition, especially in regions with restricted access to healthcare facilities and iron supplements, mirroring the low percentage of prior iron supplementation (8.1%) noted in your findings.

Furthermore, the research conducted by Mondal et al. (2018) explicitly examines the problem of nutritional anemia in India, indicating that a significant proportion of children experience both anemia and malnutrition, frequently associated with insufficient iron consumption and low levels of

preventative supplementation [24]. Their study indicates that tackling these nutritional issues necessitates comprehensive public health policies that emphasize both dietary enhancements and healthcare accessibility. The lack of hemoglobinopathies and hematological illnesses in your sample corresponds with the observations of Calcaterra et al. (2016), who indicate that although anemia may arise from several sources, dietary inadequacies are often the predominant causes in juvenile populations [25]. Their research underscores the necessity for focused measures to combat nutritional anemia, emphasizing that several children have anemia primarily owing to dietary deficiencies rather than chronic illnesses.

Nutritional evaluations indicated that although more than half of the participants were deemed well-nourished, a significant proportion exhibited different levels of malnutrition, highlighting the necessity for focused treatments. The detection of chronic malnutrition in 5.4% of the cohort underscores a vital focus for health initiatives, given that chronic malnutrition might have enduring consequences on infant development. A research by Black et al. (2013) underscores the need of tackling both acute and chronic malnutrition in children [26]. Their research demonstrates that chronic malnutrition, characterized by stunting, is associated with enduring developmental abnormalities and underscores the importance of early treatments to avert such consequences. The finding of 5.4% of children in your research with chronic malnutrition highlights the necessity for health initiatives focused on enhancing food quality and nutritional education for families.

Furthermore, the results of a comprehensive review conducted by Dewey and Begum (2011) demonstrate that dietary interventions designed for early infants can significantly enhance growth and health outcomes [27]. They assert that initiatives aimed at enhancing the accessibility and intake of nutrient-rich meals can alleviate the effects of malnutrition, indicating a proactive strategy to meet the varied nutritional requirements of children across different socioeconomic backgrounds. Furthermore, Jha et al. (2024) emphasize the necessity of including nutritional evaluations into standard health examinations for children, facilitating the early identification of at-risk groups and allowing for prompt treatments [28]. This strategy corresponds with the necessity for specialized health initiatives, as shown in your results, to tackle both acute nutritional deficits and enduring health repercussions associated with malnutrition.

The results of our study demonstrate a notable level of maternal awareness of iron deficiency anemia (IDA), with 78.4% of mothers identifying the disease. A research by Dutta et al. (2023) revealed that insufficient comprehension of anemia's risk factors among mothers might hinder timely diagnosis and treatment, highlighting the need for extensive educational initiatives to enhance awareness [29].

The significant acknowledgment of the necessity for treatment (87.8%) highlights an awareness of the health consequences of IDA, along with the findings of Rodolpho et al. (2015) [30]. Their research indicates that although mothers may acknowledge the need for therapy, insufficient understanding about the identification of symptoms and risk factors might lead to underreporting and mismanagement of the disease. This underscores the possibility of educational interventions to provide mothers with the information necessary for early identification.

A comprehensive evaluation by Gelaye et al. (2023) corroborates that increased maternal education markedly enhances the health outcomes of children with IDA [31]. The analysis suggests that educational programs aimed at mothers might enhance knowledge of dietary requirements and anemia symptoms, promoting early intervention and improved management of the illness. The laboratory results from your study indicate mean hemoglobin levels markedly below the normal range, along with signs of microcytic and hypochromic anemia, highlighting the large prevalence of iron deficiency anemia (IDA) in this group. These findings align with the research conducted by Domellöf et al. (2014), which emphasizes that young children are more susceptible to dietary deficiencies, including iron deficiency anemia (IDA), owing to their accelerated growth and developmental requirements [32]. The high incidence of low hemoglobin levels in this cohort is alarming, since research indicates that untreated anemia may result in enduring cognitive and developmental impairments in children (Pivina et al., 2019) [33].

A systematic review by Bathla et al. (2022) highlights the global public health issue of iron deficiency anemia, especially in children under five years of age [34]. The analysis determined that young children in low- and middle-income countries often have low hemoglobin levels attributable to insufficient dietary iron consumption and the poor absorption of iron in local diets. This corresponds with your findings, indicating that dietary therapies designed to enhance iron consumption may be advantageous. A research by De et al. (2021) further substantiates your findings by showing that microcytic and hypochromic red blood cell indices are common in people afflicted with IDA [35]. Their research demonstrates that early identification via laboratory evaluations might inform successful treatment approaches, highlighting the necessity of regular anemia screening in young children.

Conclusion

This study emphasizes the considerable incidence of iron deficiency anemia (IDA) in children aged 6 months to 2 years, highlighting the critical necessity for focused dietary treatments. With 14.9% affected by anemia and 24.3% suffering from chronic malnutrition, the data indicate significant health difficulties intensified by low rates of previous iron supplementation. Maternal awareness of iron deficiency anemia is notably high; yet, deficiencies in information of risk factors and symptoms highlight an urgent requirement for improved educational programs. The laboratory results reveal a considerable burden of anemia, with mean hemoglobin values markedly below the normal range, consistent with current research on the vulnerabilities of this age group. Mitigating these nutritional deficits by community-based initiatives, educational campaigns, and enhanced access to iron-rich foods is crucial for fostering better outcomes and averting long-term developmental repercussions in young children.

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