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Original Research Article

To Investigate the Correlation between Maternal Nutritional Knowledge and Iron Deficiency Anemia in Children of 6-24 Months of Age

Suman Bharti[1], Nupur Niharika[2]

[1]Assistant Professor, Department of Pediatrics, Netaji Subhas medical College and Hospital, Bihta, Patna, Bihar, India

[2]Associate professor, Department. of psychiatry, Government Medical College and Hospital,Bettiah, Bihar, India

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Corresponding Author: Dr. Nupur Niharika
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Abstract

Aim: To investigate the correlation between maternal nutritional knowledge and iron deficiency anemia in children aged 6 months to 2 years in a tertiary care hospital.

Materials and Methods: This study was carried out in Department of Pediatrics, Netaji Subhas medical College and Hospital, Bihta, Patna, Bihar, India. Children aged 6 months–2 years admitted at the hospital during the study period were included. Any child with chronic disorders such as hemoglobinopathies, hemolytic anemia, and treated for anemia and those on any immunosuppressants such as steroids and biologics were excluded as an indirect measure to eliminate anemia of chronic disease. Length and weight were measured uniformly using infantometer and digital weighing machine to the nearest 0.1 cm and 0.001 kg, respectively. Nourishment was graded based on the World Health Organization (WHO) guidelines and chronically malnourished children were excluded from the study. Children were classified based on Modified Kuppuswamy scale of socioeconomic strata.

Results: Of the 410 children, 231 (56.34%) were anemic. Moderate anemia was found in 100 (24.39%) and only 6 (1.46%) had severe anemia. Maternal knowledge regarding cow's milk was poor as 72% had a faulty belief that it increases iron absorption, whereas 13% were unaware of the relationship between cow's milk and anemia. Many mothers (71%) believed anemia to occur only in children on vegetarian diet. Around 72% mothers recognized green leaves and jaggery to be enriched with iron. Although 80% identified vitamin C containing fruits, many were not aware of its vital role in increasing the iron absorption. Most (83%) had a misconception that meat contains only fats, not iron. In our study, majority (68%) of mothers had "fair" and only few (16%) had "good" awareness. Out of 66 (16.09%) mothers with "poor" awareness, a whopping 95.45% had anemic children. Mothers with "fair" awareness had half (55%) their children affected by anemia, whereas only around one-fifth of children were anemic among mothers with "good" awareness on nutrition (p 0.001, Chi-square 72.16).

Conclusion: Despite the advent of the internet available in everyone's hand, the knowledge of anemia remains shallow. Nutrition in the latter half of infancy is vital. Information regarding the negative influences of cow's milk on hemoglobin ought to be spread. Mothers must be enlightened on the importance and source of nourishment in a weaning child. Improving maternal educational status will address the concerns on IDA.

Keywords: IDA, anemia, Nutrition,

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Introduction

Iron deficiency anemia (IDA) poses a significant health challenge worldwide, impacting both maternal and child health outcomes. This condition is particularly critical during early childhood (6 months to 2 years), a period marked by rapid growth and development where nutritional deficiencies can have long-lasting effects. Maternal nutritional awareness plays a pivotal role in shaping the dietary choices and health outcomes of their children, especially concerning iron intake and absorption. Iron deficiency anemia affects approximately 1.24 billion people globally, with children under 5 years old and pregnant women being particularly vulnerable (WHO, 2021). [1] Insufficient iron intake during pregnancy can lead to low iron stores at birth, predisposing infants to IDA during the vulnerable early months of life when breastfeeding or introduction to complementary foods may not provide adequate iron. Maternal nutritional awareness encompasses knowledge, attitudes, and practices related to optimal nutrition for both maternal health and child development. Studies underscore that maternal dietary choices significantly influence the nutritional status of

infants and toddlers, impacting their risk of IDA. [2] Mothers who are knowledgeable about the importance of iron-rich foods are more likely to integrate them into their children's diets, thereby reducing the risk of IDA.

The iron status of infants is directly influenced by maternal iron status during pregnancy and lactation. Iron deficiency in pregnant women increases the likelihood of adverse outcomes such as low birth weight and preterm birth, factors that heighten the risk of IDA in infancy. [3] Breast milk, crucial for infant nutrition, may also be deficient in iron if maternal stores are inadequate, further exacerbating the risk of IDA in exclusively breastfed infants. Efforts to enhance maternal nutritional awareness are critical in preventing IDA in young children. Educational programs targeting pregnant women and mothers of infants can provide essential information on the importance of iron-rich foods, dietary diversity, and optimal feeding practices. [4] These programs aim to empower mothers with the knowledge and skills necessary to ensure adequate iron intake for their children, thereby mitigating the risk of IDA. Community-based interventions and healthcare provider counseling play integral roles in promoting maternal nutritional awareness and improving child health outcomes. Integrated approaches that combine nutrition education with access to affordable and diverse food options have demonstrated efficacy in reducing the prevalence of IDA among young children. [5] Healthcare providers, including midwives and pediatricians, are pivotal in counseling mothers on iron supplementation during pregnancy, appropriate breastfeeding practices, and introducing iron-rich complementary foods to infants.

Materials and Methods

This study was carried out in Department of Pediatrics, Netaji Subhas medical College and Hospital, Bihta, Patna, Bihar, India for 12 months . Children aged 6 months–2 years admitted at the hospital during the study period were included. Any child with chronic disorders such as hemoglobinopathies, hemolytic anemia, and treated for anemia and those on any immunosuppressants such as steroids and biologics were excluded as an indirect measure to eliminate anemia of chronic disease. An informed written consent was obtained from the mothers of these children. Later, a pre-designed pro forma was used to record the relevant information. The two pages pro forma would include six sets of questionnaire. Only the mother was allowed to answer the questionnaire. The first part comprises general details including demography, personal data, socioeconomic status, and family background. Information pertaining to significant history of both mother and child was included in the second part. A detailed nutritional history of the child was assessed in the third part of the pro forma. Clinical presentation and investigation details were recorded in the fourth and the fifth, respectively. The final part of the questionnaire was added to analyze the awareness of the mothers on anemia and their extent of knowledge on the risk factors, clinical features, and the importance of treating IDA.

Length and weight were measured uniformly using infantometer and digital weighing machine to the nearest 0.1 cm and 0.001 kg, respectively. Nourishment was graded based on the World Health Organization (WHO) guidelines and chronically malnourished children were excluded from the study. [6] Children were classified based on Modified Kuppuswamy scale of socioeconomic strata. [7] Two generations of family living in the same household were considered ‘nuclear” family. Anything beyond was considered “joint” family. Complete blood count including red blood cell indices was calculated using Coulter LH 780 Hematology analyzer. Mentzer index was calculated along to differentiate between IDA and Thalassemia. Anemia was graded as per the WHO guidelines. Questionnaire was prepared in both English and vernacular language for better understanding. On designing the questionnaire, it was validated by an expert panel consisting of a Pediatrician, healthcare workers, and academic professionals including experts in vernacular language for easy comprehensibility. A pilot study consisting of 50 mothers was performed. Initial questionnaire and methodology were modified based on the interpretations from the same with the help of experts. A total of 559 parents were given the questionnaire on a one to one interview basis. Average time taken to complete the questionnaire was 20 min. Any queries raised by the parents, while answering the questions was clarified in person. Of them, 28 parents were not willing to answer. Eighty-six answer sheets were excluded as the answers were incomplete. Answers from 445 parents were collected, of which 18 children had chronic malnutrition. Eleven children had a previous history of anemia and six children had taken iron prophylaxis in the past.

Statistical Analysis

Anemia was the primary outcome variable and knowledge on nutrition/anemia was considered as the secondary variable. Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency, and proportion for categorical variables. The association between variables of anemia and quantitative outcome was assessed by comparing the mean values. Independent sample t-test was used to assess the statistical significance. The association between explanatory variables and categorical outcomes was assessed by cross tabulation and comparison of percentages. Chi-square test was used to test the significance of statistics. $p<0.05$ was considered

statistically significant. IBM SPSS version 22 was used for statistical analysis.

Results

Of the 410 children, 231 (56.34%) were anemic. Moderate anemia was found in 100 (24.39%) and only 6 (1.46%) had severe anemia. Mean age of anemic children was 13.23±5.15 months. A greater proportion of boys had anemia (60.5% vs. 39.5%). There was no statistically significant difference between the urban and rural population. Majority (82.93%) belonged to upper lower class socioeconomic strata, of which about half (56%) of children were anemic. The difference in the proportion of anemic children between nuclear and joint family was statistically not significant. Mean maternal age was 26.49±3.46 years, ranging between 19 and 36 years (95% CI 26.15–26.82). Majority (70.9%) of elderly mothers (≥30 years) had anemic children (p=0.05). Treatment for anemia in antenatal period was done in 2.39% of mothers and all of their children were anemic. Children of unemployed mothers were less anemic (52.5% vs. 31.6%) (p<0.001). Mothers with primary education had a larger proportion of children with anemia than the mothers with middle school and graduation, 85% vs. 66% and 53%, respectively (p=0.004). Majority (78%) of the mothers were aware that neural development of child could be affected by anemia. Despite WHO's efforts to enforce exclusive breastfeeding until 6 months of age, 73% of mothers preferred to initiate complementary feeds at 4 months of age. Maternal knowledge regarding cow's milk was poor as 72% had a faulty belief that it increases iron absorption, whereas 13% were unaware of the relationship between cow's milk and anemia. Many mothers (71%) believed anemia to occur only in children on vegetarian diet. Around 72% mothers recognized green leaves and jaggery to be enriched with iron. Although 80% identified vitamin C containing fruits, many were not aware of its vital role in increasing the iron absorption. Most (83%) had a misconception that meat contains only fats, not iron. These results stress the importance of maternal knowledge on nutrition and iron (Table 2). Prime source of knowledge in the community was health workers (69%) followed by mass media (15.37%) and neighbors (9.02%). Nineteen questions were divided into three categories in terms of a simple interval scale for statistical purposes. Those who answered ≤ 5, 5–10 and >10 correctly were considered to have "poor," "fair," and "good" nutritional awareness, respectively. In our study, majority (68%) of mothers had "fair" and only few (16%) had "good" awareness. Out of 66 (16.09%) mothers with "poor" awareness, a whopping 95.45% had anemic children. Mothers with "fair" awareness had half (55%) their children affected by anemia, whereas only around one-fifth of children were anemic among mothers with "good" awareness on nutrition (p 0.001, Chi-square 72.16). On an attempt to establish a correlation between maternal education status and anemic children, we found that mothers with better literacy rates had significant awareness regarding anemia and nutrition. (p = 0.001; Chi-square 22.62). Mothers of children with more than one sibling had a relatively greater incidence of "poor" knowledge unlike mothers of children with single or no sibling. This implies that those with "poor" knowledge were also unaware of the importance of birth spacing (p 0.010) (Table 3).

Table 1: Grading of anemia in children aged 6–24 months

Hemoglobin (mg/dl)	**Mild**	**Moderate**	**Severe**
	10–10.9	7–9.9	<7

Table 2 basic parameter of the participants

Parameter	**Value**	
Total children studied	410	
Anemic children	231 (56.34%)	
Moderate anemia	100 (24.39%)	
Severe anemia	6 (1.46%)	
Mean age of anemic children	13.23±5.15 months	
Gender distribution of anemic children	60.5% boys, 39.5% girls	
Urban vs. rural anemia prevalence	Not significant	
Socioeconomic status (Upper lower class)	82.93%	56% of upper lower class children were anemic
Family type (Nuclear vs. Joint)	Not significant	
Mean maternal age	26.49±3.46 years	Range: 19-36 years (95% CI 26.15–26.82)
Anemia in children of elderly mothers (≥30 years)	70.9% (p=0.05)	
Antenatal anemia treatment in mothers	2.39%	All of their children were anemic

Maternal employment status	52.5% unemployed, 31.6% employed (p<0.001)	
Maternal education level	85% primary, 66% middle school, 53% graduation (p=0.004)	
Awareness of anemia affecting neural development	78%	
Initiation of complementary feeds (before 6 months)	73%	
Maternal knowledge on cow's milk and iron absorption	72% faulty belief, 13% unaware	
Belief about vegetarian diet and anemia	71%	
Knowledge of iron-rich foods (green leaves and jaggery)	72%	
Awareness of vitamin C's role in iron absorption	80%	Many were not aware of its vital role
Misconception about meat and iron content	83%	Believed meat contains only fats

Table 3: Comparison of number of siblings across knowledge about nutrition and anemia (n=410)

Number of siblings	**Maternal awareness on anemia and nutrition**			**Chi square**	**p value**
	Poor knowledge (%)	**Fair knowledge (%)**	**Good knowledge (%)**		
Nil (N=76)	12 (15.78)	55 (72.36)	9 (11.84)	13.277	0.010
One (N=302)	42 (13.90)	208 (68.87)	52 (17.21)		
More than one (N=32)	12 (37.5)	17 (53.12)	3 (9.375)		

Discussion

In India, illiteracy, demographic backgrounds and economy act as a hindrance to the development in terms of health. Some of the risk factors are modifiable which on recognition would help in preventing this health burden. A major proportion of anemic individuals belong to the age group 6 months–1 year (67.2%), thus reaffirming infants to be more vulnerable to anemia. With relevance to gender, boys were more anemic in accordance with several studies. [9,10] Nearly, half of these boys had moderate grade of anemia (p<0.03), mostly due to their rapid growth rate and a greater need of iron unlike girls. Our study had more anemic children in older mothers unlike other studies probably due to higher age cutoff and associated health effects. [11,12] Mother's level of education and the impact on the child has been re-established in our study as mothers with minimal education (upto primary school) had 85% of their children with anemia. [13,14] Employed mothers had a higher number of anemic children (68.39%), possibly due to coping with work schedule leading to premature cessation of breastfeeding. Apprehension on when to start the complementary feeds and lack of awareness on exclusive breastfeeding was common among mothers. With regard to the duration of breastfeeding, half (52.20%) of the children in our study were partially breastfed (4–6 months) and only 31% of them had exclusive breastfeeding. To our dismay, all the infants deprived of breast milk had anemia. Among the partially breast fed infants, higher proportion (62.14%) were anemic. This stresses the importance of the WHO's exclusive breast feeding in the early infancy sufficing the lesser iron requirements.[15] Only 16% of mothers were aware of the importance of timely introduction of complementary feeds, proving the misconceptions on duration of breast feeding. Iron requirements after 6 months are 0.9–1.3 mg/kg/day [15], whereas the iron content of cow's milk is 0.2–0.5 mg/L, of which only 10% is absorbed. [16] In addition, cow's milk causes asymptomatic micro-hemorrhages in intestine further increasing the loss of iron. [17] This explains the reason why excess cow's milk had a negative influence on hemoglobin level in our study (p 0.002). Many mothers (72%) falsely believed that excessive consumption of cow's milk would increase the iron content in our body. This could be the reason for the intake of more than half liter of cow's milk in 28% children in our study. Several mothers (71%) believed that only children on vegetarian diet would be affected by IDA. However, iron status is a common nutritional problem among both vegetarian and non- vegetarian consumers, despite few studies reporting IDA of higher incidence in the former. This relative increase in IDA among vegetarians is probably due to their

dependence on non-heme iron and the presence of iron absorption inhibitors in plant foods. [18] Apt feeding practices are thus fundamentally important to ensure an appropriate nutrition in a growing child.

Clinical features are non-specific in anemic children as evidenced in our study, which when untreated lead to neurodevelopment delay and cognitive deficits. Their attention span is often reduced and this reflects on the child's academic performance. [19] On a positive note, 78% of the mothers had acknowledged the possibility of neural development being affected by anemia. Understanding this would stress the importance of supplementing iron in infants. The prime source of knowledge in our study was the community health workers (69%). Training and engagement of the health workers are critical in increasing the healthcare awareness in low- to middle-income countries. [20] Parenting knowledge plays a key role in the biological, physical, socioeconomic, and cognitive needs of the child. It also has a direct influence on their everyday decisions about upbringing, developmental expectations which, in turn, determines their child's health and well-being. [21] Overall most (n=280) of the mothers had "fair" knowledge of anemia and its implications. Mothers with "poor" understanding of nutrition predominantly had anemic children. Furthermore, mothers with better educational status had better awareness in terms of questionnaire. Thus, maternal knowledge plays a key role in preventing anemia. Although our study had a pre-tested structured validated questionnaire, there are possibilities of recall bias in some sections. However, this study could serve as a benchmark for future analysis with special regard to maternal role-play. It would help the health workers and policy makers to formulate a strategy and provide awareness to the prospective mothers on child nutrition, thereby preventing anemia on a large scale.

Conclusion

Despite the advent of the internet available in everyone's hand, the knowledge of anemia remains shallow. Nutrition in the latter half of infancy is vital. Information regarding the negative influences of cow's milk on hemoglobin ought to be spread. Mothers must be enlightened on the importance and source of nourishment in a weaning child. Improving maternal educational status will address the concerns on IDA. Ultimate goal must be to target the mothers to take rational decisions rather than believing the faculty of age-old aphorisms. Role of Pediatricians in creating adequate awareness among these mothers is enormous.

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