Original Article

Maternal nutritional awareness and iron deficiency anemia in children aged 6 months–2 years in a tertiary care hospital in Coimbatore, Tamil Nadu

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ABSTRACT

Objective: This study aims to analyze the risk factors and vital role of mothers in prevention of nutritional anemia in the early childhood. **Methods:** A hospital-based cross-sectional study done in Coimbatore for 2 years. Using a pre-tested structured validated tool, mothers of children aged 6 months–2 years were interviewed to collect information on factors contributing to anemia with special regard to maternal knowledge. **Results:** Anemia was more in the latter half of infancy (67.2%) with male predominance (60.5%). An affirmative association between increased cow's milk intake and low hemoglobin was present (p=0.002). Employed and less educated mothers had more anemic children (p<0.05). Of 16% mothers classified as "poor" awareness, 95.45% children had low hemoglobin (p<0.05). **Conclusion:** Recognizing the causative factors plays an essential role in preventing iron deficiency anemia (IDA). Exclusive breastfeeding must be promoted, along with avoiding excessive cow's milk intake. Intervening at the right period with age-appropriate foods becomes a necessity. Maternal illiteracy has a positive correlation with anemia in infants. Improving maternal awareness by the physicians will pave the road toward a nation free from anemia.

Keywords: Maternal awareness, Iron deficiency anemia, Child nutrition, Weaning

Anemia, a major global public health burden, affects 25% of the population worldwide [1]. Although anemia is multifactorial, iron deficiency anemia (IDA) is the major cause (42%) [2]. Affected children have nonspecific symptoms; therefore, a greater proportion of them remains undiagnosed unless a health problem ensue [1,3]. Inappropriate weaning in the infancy and faulty feeding practices is some of the early contributors to anemia. Apart from these amenable risk factors, low birth weight and premature infants are at a higher risk of developing anemia [4]. All these factors, leading to IDA during infantile and early childhood, has a negative impact on the motor and neuro-cognitive function [5].

Understanding the underlying barriers influencing the hemoglobin level by the mothers, thereby, early detection and timely correction are an important way to prevent anemia. However, the evidence regarding the maternal influence on these risk factors is scarce. No single literature has focused on the core weaning population that was being affected. This study, therefore, was driven with an aim to compile all the contributive elements to nutritional anemia with special emphasis on mother's role in prevention.

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This is a cross-sectional observational study at a tertiary care hospital in Tamil Nadu, where there is a blend of both rural and urban population. We focused on infants aged 6 month–2 years, as they form the crux of the IDA among children worldwide. Mothers were evaluated to draw a parallel between their knowledge and the degree of anemia in these children.

MATERIALS AND METHODS

This study was carried out at a tertiary care hospital from September 2017 to July 2019. 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. The study protocol was approved by the Hospital Ethics and Scientific Committee. 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

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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 [1] (Table 1).

Questionnaire was prepared in both English and vernacular language (Tamil) 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 (Fig. 1).

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 [8].

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

Table 1: Grading of anemia in children aged 6–60 months

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

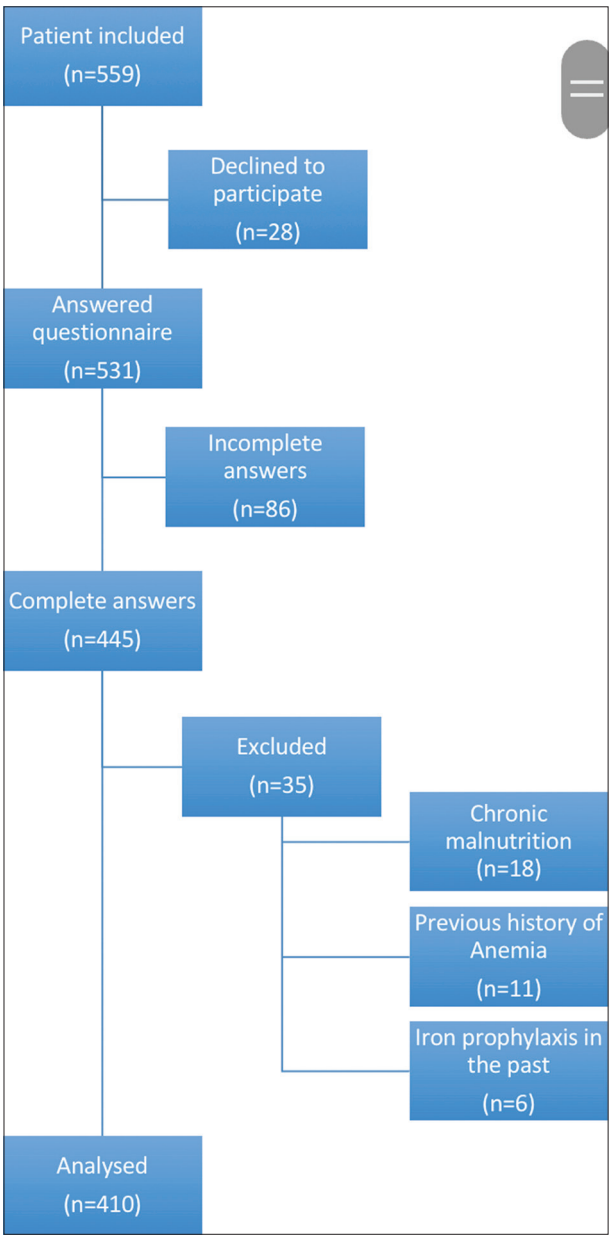

Figure 1: CONSORT flow diagram of patients included in the study

Table 2: Tabular column showing the percentage of answers by the mothers (n=410)

Correct answer	No. of correct answers (%)	No. of incorrect answers (%)
Anemia is a deficiency of hemoglobin	320 (78)	90 (22)
Iron is important for carrying oxygen in the blood to various organs	105 (25.6)	305 (74.4)
Infants at weaning age are at high risk for anemia	71 (17.3)	339 (82.7)
Low birth weight is a risk factor for anemia in newborns	96 (23.4)	314 (76.6%)
Anemia affects both vegetarians and non-vegetarians equally	63 (15.4)	347 (84.6)
Large quantities of cow's milk decreases iron absorption	63 (15.4)	347 (84.6)
Complementary feeds should be started at 6 months	67 (16.3)	343 (83.7)
Jaggery contains more iron	291 (71)	119 (29)
Green leaves are rich in iron	301 (73.4)	109 (26.6)
Meat is rich in iron	70 (17.1)	340 (82.9)
Orange is rich in vitamin C	327 (79.8)	83 (20.2)
If mother takes iron supplements, breastfed infant doesn't get more iron	327 (79.8)	83 (20.2)
Vitamin C is necessary for absorption of iron	318 (77.6)	92 (22.4)
Anemia is often asymptomatic	320 (78)	90 (22)
Anemia can cause neurodevelopmental delay in infants	320 (78)	90 (22)
Government provides free iron supplements	40 (9.8)	370 (90.2)
Anemia can be prevented	300 (73.2)	110 (26.8)
Iron causes constipation but should not be avoided.	12 (2.9)	398 (97.1)
Blood transfusion is not necessary for all children with anemia	38 (9.3)	372 (90.7)

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

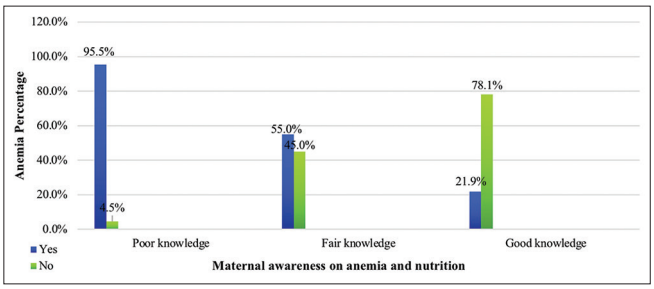

Figure 2: Stacked bar chart of comparison of knowledge among the mothers of anemic and non-anemic and non-anemic children (n=410) (p value < 0.001; Chi-square 72.16)

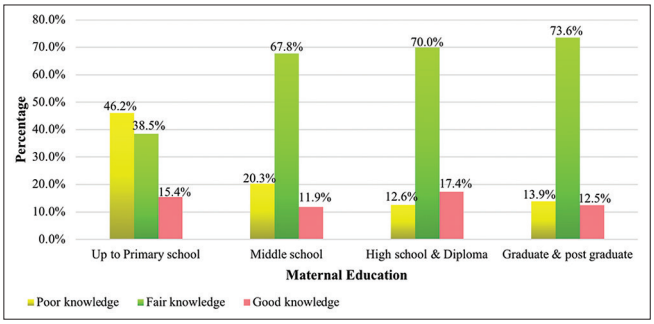

Figure 3: Clustered bar chart showing the association between maternal awareness and their education status (N=410)

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) (Fig. 2).

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) (Fig. 3). 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).

DISCUSSION

In India, illiteracy, demographic backgrounds and economy act as a hindrance to the development in terms of health. Some of

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)		

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 [5,19]. 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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