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Original Research Article

Iron deficiency anaemia in young children (6 to 23 months) in relation to complementary feeding practices in rural Telangana, India

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ABSTRACT

Background: Iron deficiency, is the most common micronutrient deficiency seen in all age groups throughout the world. Young infants are more vulnerable because of growing size and increased demand. Iron deficiency anaemia due to improper complementary feeding practices in young children, will affect growth, cognitive and immune functions of the growing child.
Methods: A cross sectional study was conducted from 01-05-2016 to 01-02-2017, at the Department of Paediatrics, S. V. S. Medical College and Hospital, Mahabubnagar, Telangana, India. The study included 130 children attended to our well baby clinics. A questionnaire was filled by mothers after taking consent. Data was Collected data was analysed using statistical package SPSS software version-19. Chi-square test was carried to test the relation. P-Value < 0.05 was considered as significant.
Results: Prolonged breast feeding, late weaning, parent's educational status and socioeconomic status are found to significant (p value <0.05) risk factors in contributing to the development of iron deficiency anaemia.
Conclusions: As young infants are more prone for iron deficiency anaemia in the later part of first year, implementation of proper complementary feeding practices as advised by Infant and Young Child Feeding practices are essential.

Keywords: Complementary feeding practices, Iron deficiency anaemia, Prolonged breast feeding

INTRODUCTION

Iron deficiency is the most common and widespread nutritional disorder in the world affecting a large number of children and women in developing countries. Almost 2 billion people-over 30% of world's population are anemic, many due to iron deficiency.[1]

Iron, a very important micronutrient and it plays a vital role in humans. Iron functions as a component of a number of proteins including enzymes and hemoglobin, the latter being important for the transport of oxygen to tissues throughout the body for metabolism. Important subclinical and clinical consequences of iron deficiency are impaired physical work performance, developmental delay, cognitive impairment and adverse pregnancy outcomes. Once the degree of iron deficiency is sufficiently severe to cause anaemia, functional disabilities become evident. Investigators have demonstrated lower mental and motor test scores and behavioural alterations in infants with iron deficiency anaemia. Specific central nervous system processes (e.g., slower nerve conduction and impaired memory) appear to remain despite correction of the IDA. Current thinking about the impact of early iron deficiency anaemia attributes some role for "functional isolation" a paradigm in which the normal interaction between stimulation and learning from the physical and social environment is

altered. IDA is associated with impaired host defence mechanisms against infections such as CMI and phagocytosis.[2]

Full-term infants are normally born with adequate iron stores in the liver and hematopoietic tissues because of destruction of fetal red blood cells soon after birth. This leads to deposition of iron in these tissues, especially of the cord is legated after it stops pulsating. Breast milk is relatively low in iron, although the iron in breast milk is much better absorbed than that in cow's milk. Iron deficiency commonly develops after six months of age if complementary foods do not provide sufficient absorbable iron, even for exclusively breastfed infants.[3]

Iron deficiency anaemia (IDA) is highly prevalent in less developed countries, but also remains a problem in developed countries where other forms of malnutrition have already been virtually eliminated. Iron deficiency is not the only cause of anaemia, but where anaemia is prevalent, iron deficiency is usually the most common cause. Iron deficiency anaemia is most prevalent and severe in young children (6-24 months) and women of reproductive age. Infants are normally born with plenty of iron. However, beyond 6 months of age, iron content of milk is not sufficient to meet many infant's requirements and complementary foods are usually low in iron.[4]

Infant and young child feeding practices advises timely introduction of complementary foods (solids, semisolids or soft foods) after the age of six months i.e., 180 days. The food should be a "balanced food" consisting of various (as diverse as possible) food groups/ components in different combinations. Iron fortified foods, iodized salts, vitamin A enriched foods etc. are to be encouraged. Hence, we have taken up the study to observe the iron status of young infants i.e., 6-23 months of age in relation to currently existing feeding practices.[5]

METHODS

Subjects were selected from children in the age group of 6 to 23 months that were brought by their parents to our well baby clinics. Among these 130 term, AGA and breast-fed children and whose mothers were willing to undergo the blood test were included in the study.

Preterm infants, children with acute and chronic illnesses, with CRP more than 6mg/dl, those suffering from haemolytic anaemia, children on hematinics and mothers who were not willing for blood tests were excluded.

Necessary data was collected in a pre-structured questionnaire that contains age, sex, address, mother's education status, father's educational status, occupation, family income, number of family members, term or preterm, birth weight, duration of EBF, details of CF. Adequacy of feeds was assessed according to WHO recommendations.[6] Socio-economic status is determined according to modified Kuppuswamy scale.[7] Blood was collected for CBP, CRP and ferritin estimation. Anaemia was graded according to WHO classification.[8] Normal ferritin levels were taken as per WHO norms.[9] Collected data was analysed using statistical package SPSS software version-19. Chi-square test was carried to test the relation. P-Value <0.05 was considered as significant.

RESULTS

130 children in the age group of 6 months to 23 months were included in the study. There were 75 (57.7%) males, and 55(42.3%) females showing slightly male predominance. 50 children (38.5%) were in the age group of 19-23 months constituting the largest group of the study population. Followed by 36 (27.7%) children in 12-17 months, and 23 (17.7%) in 9-11 months and only 21 (16.2%) in 6-8 months. 33 mothers (25.4%) and 42 fathers (32.3%) were educated up to inter and above.

More subjects (44.6%) belong to class III i.e., lower middle, followed by 43.1 % in class IV i.e., in upper lower. There were very few subjects in class II (upper middle), class IV (lower) and extremely low i.e., only 0.8% in upper class.

112 (86.2%) of children are either first in the birth order or had birth interval of >2years. A small percentage of children (13.8%) had birth interval of <2 years which is a risk factor for normal growth. Feeding practices: Data revealed 63 (48.5%) mothers had given EBF for 6 months. 14 (10.8%) mothers had given EBF for <6 months. These mothers started either mixed feeding or early complementary feeds. However, 2 of them started CF at the proper time excepting one mother who started late CF. 53 (40.8%) mothers had given exclusive breast feeds for >6 months.

65 mothers (50%) started CF at the recommended age of 6 months (180 days), 11(8.5%) mothers initiated CF early and 48 (36.9%) mothers initiated later than 6 months. 6 (4.6%) mothers were not initiated CF (still continuing EBF (1 using diluted buffalo milk) and were counselled properly. Homemade foods were used by 64.6% of mothers but recommended frequency was maintained by 4.6% of mothers.

Out of 130 children only 11(8.5%) were maintaining normal haemoglobin levels i.e., 11 or >11 G% and remaining 91.5% children were suffering from various grades of anaemia. 19 (14.6%) children had mild anaemia, 80 (61.5%) children had moderate anaemia, 20(15.4%) children were suffering from severe anaemia.

Ferritin levels were maintained within normal limits in 61 (46.9%) which includes 11 non-anaemic and 50 anaemic children and decreased in 69 (53%) subjects. The demographic profile of the study subjects was given in Table 1. Statistical analysis was done to find out the correlation of anaemia to various factors.

Table 1: Socio demographic profile of participants.

Variable	Frequency (%)
Age	
6-8 months	21 (16.2)
9-11 months	23 (17.7)
12-18 months	36 (27.7)
19-23 months	50 (38.5)
Sex	
Males	75 (57.7)
Females	55 (42.3)
Mother's educational status	
Not educated	37 (28.5)
Primary	16 (12.3)
High school	44(33.8)
Inter and above	33 (25.4)
Father's educational status	
Not educated	27 (20.8)
Primary	11 (8.5)
High school	50 (38.5)
Inter and above	42 (32.3)
Socioeconomic status	
Class I (upper)	1 (0.8)
Class II (upper middle)	10 (7.7)
Class III (lower middle)	58 (44.6)
Class IV (upper lower)	56 (43.1)
Class V (lower)	5 (3.8)
Birth order	
First child	65 (50.0)
Second child	59 (45.4)
Third child	6 (4.6)
Birth interval	
<2years	18 (13.8)
>2years or first child	112 (86.2)
Duration of EBF	
For 6 months	63 (48.5)
<6 months	14 (10.8)
For >6 months	53 (40.8)
Initiation of CF	
On recommended time	65 (50)
Early initiation	11 (8.5)
Late initiation	48 (36.9)
Not initiated	6 (4.6)
Quality	
Home made	84 (64.6)
Commercial	40 (30.8)
Continued breast feeds	6 (4.6)
Frequency	
As per who recommendation	6 (4.6)
< than required	31 (23.8)
Irregular	93 (71.5)
Grade of anemia	
Normal	11 (8.5)
Mild anaemia (10-10.9)	19 (14.6)
Moderate anaemia (7-10)	80 (61.5)
Severe anaemia (<7)	20 (15.4)
Ferritin grading	
Normal	61(46.9)
Decreased	69 (53)

This showed that age was directly correlated to severity of anaemia with highly significant p <0.05 (0.003). There were 14.3% of children who were maintaining normal haemoglobin levels in 6-8 months of age which was showing a decreasing trend later. Whereas severe anaemia was more common in second year Table 2.

Table 2: Severity of anaemia in children of different age groups.

Age in months	Non-anaemic (%)	Mildly anaemic (%)	Moderate anaemia (%)	Severe anaemia (%)
6-8	14.3	42.9	42.9	0
9-11	13	4.3	56.5	26.1
12-17	2.8	13.9	63.9	19.4
18-23	8	8	70	14.1

Sex did not show any correlation to severity of anaemia with p >0.05 (0.200). Mother's educational status, father's educational status, and socio economic status had an impact in maintaining haemoglobin levels with highly significant pvalue-0.001, 0.030, 0.000 respectively. 18.2% of children whose mothers were studied up to inter and above were maintaining normal haemoglobin levels in contrast to children with mothers of no primary education. In this group, all children were suffering from more with severe degree (27%). Similar finding was observed even with father's educational status. This showed growing participation of fathers in upbringing of children. Socio economic status also showed similar impact with more percentage of children (60%) were suffering from severe anaemia in class V. Birth order and birth interval did not show any influence on anaemia with p >0.05 (0.216, 0.09).

Duration of EBF: In mothers who had given prolonged breast feeding moderate anaemia was observed in 71.7% of subjects and severe anaemia in 20.8% of subjects. It was observed that duration breast feeding was directly correlated with severity of anaemia (p-0.01). Prolonged exclusive breast feeding without CF worsens anaemia. Time of CF: Similar findings were observed with late initiation of CF. Children who received CF at recommended time were less affected than children with prolonged EBF (p= 0.01). Quality and frequency: both have impact on prevalence of anaemia with p <0.05. Children who were receiving CF irregularly were suffering more from moderate anaemia (66.7%), when compared to subjects who were receiving at recommended frequency (33.3%).

Ferritin: Various factors influencing the reserves of ferritin were studied. Ferritin levels showed decreasing trend with age. Children of 6-8 months had good reserves than those in later part of second year.90.5% of children in 6-8 months of age had good reserves where as it was only 30% in 18-23 months. And age had significant effect on ferritin reserves (p=0.000). 49.3% of males and 58.2% females showed low reserves. Although females were

suffering more it was not statistically significant with p >0.05 (0.38).

Table 3: Relation of socio-economic status to the severity of anaemia.

Socio-economic status	Normal (%)	Mild anaemia (%)	Moderate anaemia (%)	Severe anaemia (%)
Class I	0	100	0	0
Class II	30	30	40	0
Class III	13.8	19.0	62.1	5.2
Class IV	0	7.1	67.9	25.0
Class V	0	0	40.0	60.0

Mother's educational status, father's education and socioeconomic status had impact on ferritin reserves with statistically significant p value being 0.000, 0.02,0.001 respectively. Subjects who belong to low socioeconomic group like class iv (69.6%) and class v (100%) had low reserves. Birth order and birth interval did not show any correlation to the level of ferritin with p >0.05. Duration of breast feeding for longer time showed a correlation to the ferritin reserves (p=0.000). Prolonged EBF without CF led to the drop-in ferritin reserves. This was confirmed with the effect of time of CF showing similar finding (p=0.000). Children who had prolonged EBF and subjects who were initiated CF after 6 months were suffered with exhaustion of ferritin levels. Regarding quality of complementary feeds children who were on homemade preparation (64.3%) and on prolonged EBF with no complementary feeds (66.7%) had low ferritin than children who were on commercial preparation (27.5%) with significant p (0.001). Frequency CF did not show any co-relation to ferritin reserves.

DISCUSSION

In the present study, out of 130 children 11(8.5%) subjects had normal haemoglobin levels. 119 (91.5%) were suffering from various degrees of anaemia (Mild-14.6%, moderate- 61.5%, and severe-15.4%). Majority of children were suffering from moderate anaemia (61.5%).

But when ferritin levels were estimated 61 (46.9%) were maintaining normal ferritin levels although 50 of them were suffering from anaemia and is not consistent with iron deficiency anaemia and 69 (53.1%) children with anaemia had low levels of ferritin. It was shown by Abraham et. al. that even slight clinical signs of respiratory tract infection will raise the ferritin levels. He showed that only highly sensitive assay CRP is needed rather than routine methods of measuring CRP to rule out infection.[10]

Prolonged exclusive breast feeding was associated with various degrees of anaemia and decrease in reserves of ferritin in the present study and the results were consistent with the study done by Jonathon L. Maguire et al.[11] Here the difference being selection of age group and a large sample size. Although iron bioavailability of breast milk is good it may not be sufficient to the growing needs of the body after 6 months. Hence prolonged breast feeding lead to IDA.

Late weaning was shown as the most important risk factor for anaemia by Sulthan AN, Zuberi RW in their case control study done at the community health centre of Agha Khan University Hospital at Karachi. Pakistan. Family income, mother's education, number of pregnancies are other risk factors that were shown influencing the degree of anaemia.[12] Similar observation was noted in the present study. Lozoff B et al, Sargent et al, Ali NS, Zuberi RW reported that low socioeconomic status is associated with iron deficiency anaemia in their studies.[13-15] The present study supports this observation.

In our study, we observed that children with mother's higher education status were less prone for anaemia. Similar findings were observed in Zhao A et al, in 2012.[16] Birth order, birth interval, sex did not have any influence on the development of anaemia in our study.

CONCLUSION

Prolonged breast feeding i.e., beyond the age of 6 months, late initiation of complementary feeding, low educational status of parents especially mother, poor socio-economic status are definitive risk factors for development of IDA in this vulnerable group.

Hence, the guidelines for Infant feeding and iron supplementation should be followed strictly and this should reach to the mothers to reduce the prevalence of IDA. Biweekly iron supplementation to preschool children 6 months to 5 years should be given as recommended by national Iron plus initiative as per WHO. Since anaemia is not just about medical interventions but to a great degree about behavioural change (both in terms of dietary habits and compliance) an extensive campaign should be developed.

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