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ORIGINAL RESEARCH

Determination of infantile feeding practices using blood parameters for assessment of iron deficiency anemia in a tertiary care hospital of southern Kerala: A prospective cross-sectional study

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ABSTRACT

Introduction: Feeding and dietary practices are the most known factors influencing Iron deficiency Anemia. A study was conducted to determine the association between the infantile feeding practices and iron deficiency anemia during early childhood.**Objective:** To determine the association between the infantile feeding practices and iron deficiency anemia based on Blood Parameters among young children from 7 months to 2 years of age group.**Materials & Methods:** A cross-sectional Study was conducted at a tertiary care hospital with 229 (7months- 2 years) children. Details regarding infant feeding practices were collected from primary caregiver using interviewer-based questionnaire. RBC indices and Peripheral smear was used to identify Iron deficiency anemia.**Results:** Infants who were exclusively breastfed upto 6 months and timely weaned according to WHO standards was found to be protected from Iron deficiency anemia. Late weaning was associated with increased risk of IDA. Other infant feeding practices such as decreased food diversity and cow's milk feeding was also identified to cause iron deficiency anemia.**Conclusion:** This study concludes the importance of exclusive breastfeeding until 6 months of age and highlights the need for proper, timely, and appropriate knowledge regarding the introduction of complementary feeding in children. Additionally, it identifies late weaning as a risk factor for the development of iron deficiency anemia.

Key words: Iron deficiency anemia, exclusive breast feeding, complementary feeding practices

INTRODUCTION

Nutritional anemia is one of the most common hematological abnormalities affecting all ages across the world. A greater proportion of young children born to populations of developing countries have been found to be suffering from Iron Deficiency Anemia (IDA) which in turn affects their neurological development. Feeding and dietary practices are the most known factors influencing IDA.

For the initial six months, exclusive breastfeeding should be given to the infant without any addition of water or any other fluid to their intake, according to standards published by the World Health Organization (WHO). Adding complimentary feeds may begin at 6 months (mo.) but at least until the age of 2 years (yr.) this must continue in tandem with continued breast feeds. In order to provide sufficient energy, protein and micronutrients, appropriate complementary feeding practices should be followed. This is crucial as the child's energy and nutrient requirements can be satisfactorily covered only by this approach.

Incorrect feeding practices is basically an umbrella term that encompasses several different practices such as improper frequency, quantity as well as diversity.

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Adapting these practices may directly result in nutritional anemia. In order to evaluate these widely differing conditions, a primary blood workup is performed which also includes a complete blood count (CBC) with Red Blood Cell (RBC) Indices.

Potential characteristics for risk of IDA, commonly observed during early childhood are identified by WHO. These include a low birth-weight (LBW), history or prematurity, Exclusive Breast Feeding (EBF) that continues past 4 mo. since the time of birth without any supplementation of iron; and a practice of weaning off breast milk to whole cow's milk or other foods that are used as complementary but which aren't naturally iron rich and/or lacks in cereals fortified with iron. Other risk factors include lack of awareness in caregivers, poor socioeconomic status (SES), feeding problems or feed intolerance. Prolonged breast feeding and delayed introduction of complementary feeding has also been proved to cause IDA. Excessive use and early introduction of milk from cows can also cause IDA [1].

WHO also has laid out a detailed plan for evaluation of IDA. The primary step is the taking of CBC as part of an initial evaluation, including Hemoglobin (Hb), RBC count, RBC indices, Hematocrit (PCV), Mean Corpuscular Volume (MCV). The sensitivity value of Red Cell Distribution Width (RDW) is 82.3% while the specificity is 97.4%. Similarly, the sensitivity value of MCV was 29.2%, Mean Corpuscular Hemoglobin (MCH) was 68.1% and Mean Corpuscular Hemoglobin Concentration (MCHC) was 15%, for detecting iron deficiency but the specificity values were 98.7%, 83.1% and 96.1%. By combining an MCV < 70 femtolitres (fL) and RDW> or = 15%, the PPV (Positive Predictive Value) can be ramped upto 97.8%. The sensitivity of the serum ferritin concentration which is < 10ng/ml, was found to be 62.4% while its specificity value was 100%. Meanwhile saturation transferrin (TS) sensitivity < 12% was 72.3% while 81.3% was its specificity value. The accuracy of diagnosing IDA can be increased through the joining of combining Red cell distribution width value and MCV with the Hemoglobin (Hb). Among MCV, MCH and MCHC, in this study MCH was used as it has the highest sensitivity [2,3].

Malini M Bhattath*et al*. conducted research on Infant Youth Child Feeding (IYCF) practices. They selected a rural area in the Kollam district of Kerala for their study and after careful evaluation, a significant gap from recommended feeding practices was found. Only 60% of children were found to have initiated early breast feeding. And only 6% were given EBF till 6 (mo.). While bottle feeding was observed in 44%, 78% of them were given Colostrum. A total of 52.1% of the tested children had received iron-rich foods. All of this evidence pointed to clear case of inappropriate feeding practices in the area under study 4.

Mamiro P.S.*et al*. conducted a study titled-Feeding Practices and Factors Contributing to Wasting, Stunting, and IDA among 3-to 23-month-old children in Kilosa District, Rural Tanzania‖. At the end of a 24 hour long dietary assessment, a clear positive association with Anemia was established. The major results of the study were as follows: There was a lower coverage of recommended Iron intake from complementary feeds. In children aged 6-8 months, it was 15 %. From 9-11 months, the result came as 20% and 27% from 12-23 months. Steps were taken to immediately shield the community from IDA, by urgent implementation of Iron rich food items [5].

Tanrtacheewathorn*et al*. conducted study in a cohort of breast fed and formula fed children, titled, - Incidence and risk factors of Iron deficiency between breast fed and formula fed infants‖. The prevalence of IDA was found to be 25.7% in infants who were on breast milk and 2.9% in infants who were on formula milk. This factors like low birth weight, breast feeding and inadequate complementary feeding were the major dietary factors leading to IDA in the study [6].

MATERIALS AND METHODS

- **AIM OF STUDY:** Association of infantile feeding practices on anemia using RBC Parameters.
- **TYPE OF STUDY:** Prospective Cross- Sectional Study.
- **STUDY POPULATION:** 7 months to 2 years of age.

INCLUSION CRITERIA

1. Term Gestation (37 weeks- 42 weeks).
2. Normal Birth Weight (BW) (2.5 to 4 Kg).

EXCLUSION CRITERIA

1. Anemia due to acute blood loss.
2. Hemolytic anemia.
3. Known case of Bone marrow suppression, Genetics Syndromes, chronic illness.
4. On Therapeutic feeds.
5. On Iron or folic acid therapy.

CLASSIFICATION OF CASES

1. **GROUP A:** EBF till 6 months and then switched to complementary feeding practices recommended by WHO.
2. **GROUP B:** EBF for more than 6 months or delayed in initiating complementary feeds by WHO [Late Weaning].
3. **GROUP C:** Children whose complementary feeding was initiated before 6 months [Early weaning].

- **STUDY LOCATION:** Dr. SM CSI Medical College, Karakonam, Trivandrum.
- **STUDY PERIOD:** 18 months (December 2022-June 2024).
- **SAMPLE SIZE:** 215 using previous studies based on the formula $N= (Z\acute{a}/2)^2*P*Q/d^2$= [3.84 x 44.17x55.83]/6.625 2 = 215 [11].

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- **SAMPLING METHOD:** Consecutive Non-Probability Technique.

PROCEDURES: All admitted cases will be evaluated using venous sample.

BLOOD PARAMETERS
1. CBC (Hb, MCH, RDW)
2. Peripheral Smear (PS)

CONFIRMATION OF IRON DEFICIENCY ANEMIA [12]
1. Hb <11 gms%, MCH< 23 picograms (pg), RDW> 15%.
2. PS-Anisopoikilocytosis, Microcytic Hypochromic anemia.

- **STATISTICAL METHODS:** Chi-square Test (χ^2)-Qualitative Variables. P-value (p)= ≤ 0.05-taken as significant.

RESULTS

After enrolment, considering the inclusion criteria, out of 229 children we found that the mean age was 14.28 (±4.5 mo.) between 7 to 24 (mon.). 86 <1 yr.and143 > 1 yr. with males (115, 50.2%). SES showed was 60% belonged to Class II, followed by 30% in class III. More than 68 percent of mothers were educated above higher secondary school; of them 9 (3.9%) were professionals and 147 (64.1%) were graduates. Only 27 (11.8%) of the mothers were working. Children who were given EBF till 6 months and timely introduced on complementary feeds were found to be protective from IDA. Lateintroduction of complementary feeds was associated with, 2.3 times higher chance of developing iron deficiency anemia compared to those who were continued on EBF up to 6 months. The risk of developing anemia has been lesser in children who were given artificial feeding before 6 months. However Artificial feeding beyond 6 months showed higher chance for Iron deficiency Anemia, but it was not statistically significant. Food diversity was identified as a protective factor for IDA. Cow's milk feeding also increased the risk for IDA by 3.1 times than in children who were not given cow's milk feeding. Findings are summarized in Table 1, 2.

Table 1: Showing Infantile feeding practice indicators of study population

Sr. No.	Feeding Practice Indicators	Yes	No
1.	Early Initiation of Breast feeding	187(81.7%)	42(18.3%)
2.	Colostrum	200(87.3)	29(12.7%)
3.	Exclusive breast feeding till 6 mo.	180(78.6%)	49(21.4%)
4.	Prelacteal feeds	19(8.3%)	210(91.7%)
5.	Artificial feeding <6 months 6 mo. -1 yr.	 33(14.4%) 21(9.2%)	 177(77.3%) 208(90.8%)
6.	Bottle feeding	18(7.9%)	211(92.1)
7.	Cow's milk feeding (6 mo.-1 yr.)	27(11.8%)	202(88.2%)
8.	Continued breast feeding (6mo.-1 yr.)	215(93.9%)	14(6.1)

Table 2: Showing Association of Infantile feeding practices with anemia using RBC Parameters

Factors		Anemia (Hb, MCH, RDW), n (%)		OR (95% CI)	χ^2 p-value
		Present	Absent		
EBF till 6 months & timely initiated on complementary feeds (Group A)	Yes	58(59.8.1)	100(75.8)	0.47 (0.27-0.84)	**6.6 (0.01)**
	No	39(40.2)	32(24.2)		
Early introduction of complementary feeds (Group C)	Yes	11(11.3)	12(9.1)	1.27 (0.53-3.03)	0.31 (0.57)
	No	86(88.7)	120(90.9)		
Late introduction of complementary feeds (Group B)	Yes	29 (29.9)	20 (15.2)	2.3 (1.25-4.5)	**7.72 (0.007)**
	No	68(70.1)	112(84.8)		
Food diversity	Present	11(11.3)	29(22)	0.45 (0.21-.96)	**4.38 (0.036)**
	Absent	86(88.7)	103(78)		
Artificial feeding (<6 months)	Present	9(27.3)	24(72.7)	0.46 (0.20-0.84)	**3.95 (0.04)**
	Absent	88(44.9)	108(55.1)		
Artificial feeding (>6 months)	Present	7(16.3)	14(7.5)	2.38 (0.92-6.3)	3.2 (0.07)
	Absent	36(83.7)	172(92.5)		
Cow's milk	Present	18(18.6)	9(6.8)	3.1 (1.3-7.2)	**7.4 (0.006)**
	Absent	79(81.4)	123(93.2)		

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DISCUSSION

This study showed Group B i.e. late weaning was found to be associated with a statistically significant iron deficiency anemia than compared with Group A and C. These results are in concurrence with several of the previous studies. An earlier hospital-based study conducted in India found that a higher chance of IDA measured by a low serum ferritin was observed in children who were not given EBF for 6 months [7].

It is also worth noting that a negative association for early weaning and anemia was also uncovered by a few previous studies. In Thailand, a study was conducted, where it was seen that ID and IDA resulted from extended time of breast feeding and delayed weaning, especially Iron- rich items like meat [8]. Nonetheless, EBF till 6 months was determined as protective for anemia, while early weaning was seen to be a risk for anemia, according to the analysis of data obtained by our study. Use of artificial feeds fortified with Iron among early weaning children with working mothers may have contributed to the findings in these previous studies, since this may also decrease the chance of IDA. In the current research we conducted, a lesser proportion of 11.8% of participants were working mothers while the early weaning ones who were started on complementary feeds along with continued breast feeding belonged mostly to the 4 mo. and 5 mo. age category.

In the MINA-Brazil birth cohort, a study was conducted where a positive association between Hb level at 5 yr. and prolonged breast feeding was established [9]. This is in tandem with the results of current research, which substantiates protective effect of exclusive breast feeding on anemia.

The prevalence of IDA derived from Hb, HCT, MCV, and Serum ferritin values was high in breastfed children as compared to formula-fed children, according to a study conducted in a cohort of formula-fed and breastfed term infants in Thailand [6].

Another study conducted in the same country (Thailand) showed that an increased chance of IDA was directly connected to a decreased intake of formula milk [8]. The current study determined artificial feeding before 6 months as protective for IDA.

The current study draws a clear association between IDA and the feeding with cow's milk before 1 year. The overall odds of getting anemia in this manner have been shown to be around 3.1 times higher than for infants with no same history before age 1. These findings are remarkably similar to several other previous studies, like the one conducted in Brazil among children from 6 months to 59 months of age. In that case, an increased calorie intake from cow's milk was identified as one of the important elements of risk for anemia [10].

CONCLUSION

This study concludes the importance of exclusive breastfeeding until 6 months of age and highlights the need for proper, timely, and appropriate knowledge regarding the introduction of complementary feeding in children. Additionally, it identifies late weaning as a risk factor for the development of iron deficiency anemia.

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