FREQUENCY OF IRON DEFICIENCY ANAEMIA IN BREAST FED AND BOTTLE FED INFANTS

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ABSTRACT

Objective: To determine the frequency of iron deficiency anemia among infants presenting with highly suspected clinical features and to compare the frequency of iron deficiency anemia between breastfeeding and bottle feeding infants.

Materials and Methods: This Descriptive Cross Sectional study was conducted in the in the Department of Pediatrics Hayatabad Medical Complex, Peshawar from 22-01-2016 to 22-07-2016. A total of 164 infants suspected of having IDA were included in the study in a consecutive manner serum Hb and serum ferritin was measured to detect IDA.

Results: The mean age of the overall sample was 5.5 $\pm$ 2.3 months. The mean age of breast fed infants was 5.7 $\pm$ 2.1 months and that of bottle fed was 5.4 $\pm$ 2.4 months (p 0.329). We found IDA in 59.8% of males breast fed and 50% bottle fed infants. While IDA was found in 40.2% of breast fed female infants and 50% bottle fed. IDA of the overall sample was 19.5%. We observed IDA in 9.8% of breast fed and 29.3% of the bottle fed infants (p value 0.002).

Conclusion: IDA is common in our infant population whether breast fed or bottle fed. However, the bottle fed infants had a significantly higher prevalence of IDA compared to breast fed. This can generate a theory that bottle feeding may be associated with developing IDA.

Key Words: iron deficiency anemia, ferritin, hemoglobin, red blood cells, Breast feeding, bottle feeding.

INTRODUCTION

Iron-deficiency anemia (IDA) constitutes a significant burden of disease in infancy and childhood[1]. Iron is required for multiple functions of the body including production of hemoglobin, an essential protein found in red blood cells, and is stored in the body. Iron deficiency occurs when the level of stored iron becomes depleted[2]. IDA occurs when iron levels are sufficiently depleted resulting in low hemoglobin level and is characterized by hypochromic microcytic red blood cells[3]. Though usually infants with iron deficiency are asymptomatic, they can present with wide variety of symptoms including cognitive and behavioral problems[4]. The etiological factors include inadequate dietary iron, iron absorption and intense exercise, along with blood loss and parasitic infestations, are some cause of IDA[5]. All healthy infants have iron storage obtained from mothers and are sufficient for their exclusive breast feeding age[6].

The World Health Organization (WHO) recommends exclusive breastfeeding for the first 6 months of life (defined as feeding with only breast milk without any additional food or water) with introduction of complementary foods at 6 months and continued breastfeeding up to 2 years of age or beyond[7], based on a systematic review published in 2002[8].

Malnutrition is a major problem of in children under five years of age in developing countries. Both macro and micronutrients deficiency is prevalent in this age group. The prevalence of iron deficiency anemia (IDA) is estimated approximately 42% in developing countries and 17% in developed countries[9]. Adequate iron intake through complementary feeding is of particular importance for meeting increasing iron demands during the second half of infancy. The European pediatric guidelines recommend introducing complementary food (CF) between 17weeks and 26weeks of life[9]. In spite of growing awareness that nutrition during infancy may have profound biological effects and important consequences for both short- and long-term health, knowledge of the regulation of iron metabolism in healthy breastfed infants during the period of complementary feeding is still limited[10].

Infants, who are bottle fed (cow or formula milk), have a greater incidence of iron deficiency because of low iron content, occult intestinal blood loss associated with cow's milk consumption during infancy and inhibition of non-heme iron absorption by calcium and casein. Subsequently, growing children must obtain approximately 0.5 mg more iron daily than is lost in order to maintain a normal body concentration of 200mg[11,12]. In a systematic review, a study was found reporting 22% prevalence of IDA among infants fed on noniron-fortified formula[13]. In another study, the prevalence of anemia among children consuming cows's milk was 45.2%[14]. In another study, the frequency of IDA among infants on breast milk was reported to be 4%[15].

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The present study is designed to determine the frequency of IDA among infants presenting with highly suspected clinical features and comparing the frequency of bottle feed vs breast feed among IDA positive infants. Type of feeding commonly varies in our population due to a variety of factors and bottle feeding is considered to be the most common cause of various childhood illnesses including IDA. Anemia is a frequent complication of formula or cow milk. This study will provide us with a local data about the frequency IDA in children on breastfeeding compared to bottle feeding which is currently scarce. The results of this study will be shared with other locally available pediatricians and future recommendations may be decided either for conducting more research or practice modifications.

MATERIALS AND METHODS

Patients and Methods

This cross-sectional study was conducted at the department of Pediatrics, Hayatabad Medical Complex, Peshawar from 22-01-2016 to 22-07-2016. A total 164 patients were included in the study, using 4%[15] proportion of IDA among children on breast milk, 95% confidence interval and 3% margin of error using WHO sample size estimation formula. All children of either gender up to the age of 9 months with highly suspected clinical features of anemia were included in the study using non probability consecutive sampling technique. Patients on multivitamin, iron therapy, history blood transfusion were excluded from the study.

The study was conducted after approval from hospitals ethical and research committee. All children meeting the inclusion criteria were included in the study. The purpose and benefits of the study was explained to their mother and a written informed consent was obtained.

All infants were subjected to detailed history, followed by complete routine examination. From all the infants, a5cc of venous blood was obtained and was sent to hospital laboratory for measuring HB level. All the investigations were done by single experiences hematologist having minimum of five years of experience. Once the anemia is detected, the parents were carefully interviewed for the history of milk consumption by the infant in last six months i.e. bottle feeding or breast feeding.

All the above mentioned information including name, age, gender and type of feeding was recorded in a pre designed proforma. Strictly exclusion criteria were followed to control confounders and bias in the study results.

The collected data was stored and analyzed in SPSS version 20 for windows. Mean $\pm$ SD was calculated for numerical variables like age, Hb. Frequencies and percentages was calculated for categorical variables like gender and IDA. IDA in both groups was compared (bottle versus breast feeding) by using chi square test with a p value of $\leq$ 0.05 as significant. IDA in both groups was stratified among age and gender to see the effect modifications. All results were presented in the form of tables and graphs.

RESULTS

The study was conducted on 164 infants suspected of having anemia. There were 82 breast fed and 82 bottle fed infants included in the study. The mean age of the overall sample was 5.5 $\pm$ 2.3 months. The mean age of breast fed infants was 5.7 $\pm$ 2.1 months and that of bottle fed was 5.4 $\pm$ 2.4 months (p 0.329).

The range of age in our study was 7.5 months with minimum age of 1.5 months and maximum age of 9 months. We divided the age in three different groups i.e. 0 to 3 months, > 3 to 6months and > 6 to 9 months as given in table 1. The table 2 shows gender distribution of the sample.

While distributing the infants with regards to gender, we observed that we had 59.8% males in breast fed and 50% in bottle fed infants. Female infants were 40.2% in breast fed and 50% in bottle fed infants. (See

Table 1: Age Categories Wise Distribution of Sample

Age Groups	Feeding group		P Value
	Breast Fed	Bottle Fed	
0 to 3 months	16	16	0.374
	19.5%	19.5%	
> 3 to 6 months	25	33	
	30.5%	40.2%	
> 6 to 9 months	41	33	
	50.0%	40.2%	
Total	82	82	
	100.0%	100.0%	

Table 2: Gender Wise Distribution of Sample

Gender of Infant	Feeding group		P Value
	Breast Fed	Bottle Fed	
Male	49	41	0.209
	59.8%	50.0%	
Female	33	41	
	40.2%	50.0%	
Total	82	82	
	100.0%	100.0%	

Table 3: Frequency of Iron Deficiency Anemia Overall Sample

IDA	Frequency	Percent
Yes	32	19.5
No	132	80.5
Total	164	100.0

Groups wise statistics of IDA

Iron Deficiency Anemia	Feeding group		P value
	Breast Fed	Bottle Fed	
Yes	8	24	0.002
	9.8%	29.3%	
No	74	58	
	90.2%	70.7%	
Total	82	82	
	100.0%	100.0%	

Table 4: Male Gender Wise Stratification Of Ida In Both Feeding Groups

Iron Deficiency Anemia	Feeding group		P Value
	Breast Fed	Bottle Fed	
Yes	0	16	< 0.001
	0.0%	39.0%	
No	49	25	
	100.0%	61.0%	
Total	49	41	
	100.0%	100.0%	

Table 5: Female Gender Wise Stratification Of Ida In Both Feeding Groups

Iron Deficiency Anemia	Feeding group		P Value
	Breast Fed	Bottle Fed	
Yes	8	8	0.623
	24.2%	19.5%	
No	25	33	
	75.8%	80.5%	
Total	33	41	
	100.0%	100.0%	

table 3). The mean Hb of the overall sample was 10.9 ± 1.5 gm/dl.

According to operational definition of IDA, in our study, the IDA of the overall sample was 19.5%. We observed IDA in 9.8% of breast fed and 29.3% of the bottle fed infants. (p 0.002) as given in table 3. The table 4 and 5 shows gender wise stratification of IDA in breast fed versus bottle fed infants.

DISCUSSION

Iron deficiency anemia attributable remains the most common, treatable anemia in the world. Once the cause for the underlying blood loss or dietary deficiency is identified, the finding of anemia with microcytic hypochromic erythrocytes in conjunction with abnormal serum biochemical indices (low ferritin, low iron, low transferrin saturation,)[16]. Clinical interest therefore focuses on (a) early recognition of subclinical iron deficiency (ID) to prevent the systemic complications of this problem (b) identification of iron-deficient anemia (IDA) caused by a lack of iron in the diet, by iron malabsorption, or by increased bleeding as the underlying reason for anemia, because this condition responds promptly to therapy[17].

Adequate iron status in infancy is extremely important as iron deficiency (ID) during the first months of life can negatively affect the child's development and health with persistent effects into adulthood[18]. The associations between ID and children's health have not only been observed in developing countries, with high prevalence of malnutrition[19], but also in westernized countries[20]. ID is associated with rapid growth and exclusive breast feeding beyond six months during first year of life and the use of normal (unfortified) cow's milk before 12 months of age. However, total duration of breast-feeding was found to associate positively with iron status[21-23].

In a randomized controlled trial, higher ferritin levels were found among those receiving complementary food at 4 month of age in addition to breast milk than among those who were EBF until 6 months[24].

Previous studies have examined the relationship between iron status and feeding practices in the first 6 months of life. Exclusive breastfeeding for ≥6 months compared with exclusive breastfeeding for 0 to 4 months was associated with anemia (hemoglobin <100g/L) at 9 months of age in a study of 183 infants in Mexico City (OR: 12.2, 95% CI: 2.4–62.1)[25]. A history of late weaning (defined as adding foods and gradually reducing the amount of milk beyond 6 months of age), was associated with iron deficiency anemia in a case-control study of 150 children aged 1 to 2 years in Pakistan (60% of cases and 9% of controls were weaned late, P < .001)[26]. An observational study using data from 9930 children who were enrolled in a US Special Supplemental Nutrition Program for Women, Infants, and Children program found that hemoglobin concentrations increased from age 1 to 2 years in those who had been breastfed ≥25 weeks (P < .00001)[27]. A cross-sectional survey of 245 children aged 12 to 24 months from US NHANES (1999–2002) found that the odds of low ferritin were less with full breastfeeding for 4 to 5 months compared with full breastfeeding for ≥6 months (OR: 0.19, 95% CI: 0.06–0.57)[28]. In a randomized trial, low ferritin was associated with exclusive breastfeeding for 6 months compared with introduction of complementary foods at 4 months in 141 low-income children in Honduras (relative risk: 2.93, 95% CI: 1.13–7.56)[29]. In a randomized trial of 77 Canadian infants, low ferritin at 6 months of age was associated with exclusive breastfeeding for 6 months compared with exclusive breastfeeding plus iron supplementation from 1 to 6 months of age (33% vs 7%)[30]. The American Academy of Pediatrics Committee on Nutrition (2010) and Section on Breastfeeding (2012) now include recommendations regarding oral iron supplementation in exclusively breastfed infants[31].

Fewer studies have examined the relationship between breastfeeding practices and iron status beyond the first 6 months and into the second and third years of life. This is relevant because the WHO recommends that exclusive breastfeeding up to 6 months[32] and continues up to 2 years of age or beyond. A study of 928 term infants from the Avon Longitudinal Study examined infant feeding practices in the second 6 months of life and demonstrated that infants at 8 months of age receiving breast milk with or without some cows' milk but no formula had higher rates of anemia (hemoglobin <110 g/dL) but not low ferritin at 8 and 12 months compared with infants receiving formula at 8 months[33]. Furthermore, infants receiving <6 breastfeeds per day, compared with ≥6 breastfeeds per day, obtained greater energy from solids and greater total iron. The results from our study, which included infants receiving breast milk for up to 48 months, are complementary, suggesting that longer total breastfeeding duration, especially beyond 12 months of age, may be a risk factor for depletion of iron stores.

CONCLUSION

IDA is common in our infant population whether on breast feeding or bottle feeding. However, the bottle fed infants had a significantly higher prevalence of IDA compared to breast fed. This can generate a theory that bottle feeding may be associated with developing IDA. We recommend more studies on such hypothesis to develop associations between bottle feeding and IDA.

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