

Original Research Article

Micronutrient deficiency status in children below 2 year of age with delayed milestones

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ABSTRACT

Background: Micronutrient deficiency have strong association with delayed achievement of milestones. Objective of present study was to know the micronutrient deficiency status in children below 2 years of age with delayed milestones.

Methods: Study was carried out among 50 children below 2year of age with delayed milestones without any known cause for it. These children were evaluated for hematopoietic micronutrient deficiency and they were compared with controls.

Results: A total of 50 children (22 male and 28 female) of delayed milestone were enrolled. Maximum number of children were in age group 7-12 months. Majority of children (62%) were from BPL families. Majority of children had Wt/ Ht -1 to -2 SD. Breastfeeding was initiated late (2-6 hr) in 38%. Sixty four percent children were exclusively breast fed up to six month of age, in the rest top milk feeding was also given along with BF. No complimentary feeding was started in 51.1% children after 6 months of age. In 73% of those in whom complimentary feeding was started the amount was inadequate. Maximum children were given complimentary feeding at the age of 9-12 month. In this study significant number of patients ($p = <0.001$) had low levels of serum vit. B12 (78% v/s 10% in control), iron deficiency (66% v/s 6% in control) and deficient folic acid level (16% v/s nil in control).

Conclusions: Association was found between hematopoietic micronutrient deficiency and delayed milestone in children below 2 years age without any other risk factors.

Keywords: Complimentary feeding, Delayed milestones, Hematopoietic micronutrient deficiency

INTRODUCTION

Developmental delay (DD) is a term used for children who lack developmental milestones and skills in the motor, language and social/personal developmental areas that would be expected of normal children of their age.¹ The global prevalence of developmental delay in children is reported as 1-3%, while World Health Organization (WHO) estimates that 15% of the world's population lives with some form of disability.^{2,3}

Infancy and early childhood are the most crucial phases during which development takes place. Poverty is most important risk factors associated with poor development. Poverty exposes the child to many other risk factors such as micronutrient deficiency, lack of stimulation or excessive stress, exposure to environmental toxins, and concurrent diseases that adversely effect development.⁴

Some micronutrient deficiency affecting developmental milestone are iron, folic acid, vit. B₁₂, iodine and zinc deficiency etc.⁴

Megaloblastic anemia is more prevalent among nutritionally challenged pediatric populations in tropical and subtropical countries where it is seen mainly in the age group of 3-18 months in association with maternal deficiencies and prolonged breast feeding.⁵

The link between diet and brain development and function has attracted global attention as evidence has emerged documenting the negative consequences of nutritional deficiencies on infant cognitive and motor functioning.⁶

METHODS

This study was conducted in Paediatric ward, Balchikitsalaya MB hospital Udaipur Rajasthan during a period from May 2017 to December 2017. Permission was taken from the institutional ethical Committee.

All the children up to 24 months of age with clinical diagnosis of delay developmental, irrespective of socioeconomic background and without any apparent cause of this delay on history and physical examination, were enrolled. Enrolled children underwent a detailed workup according to predesigned data collection form. Information was obtained about child's personal data (address, age, sex, birth spacing, and birth order); education, occupation and religion of parents; socioeconomic status (family income, caste and APL or BPL); duration of breastfeeding, time of introducing complementary food and current feeding status (child's appetite and number and quantity of meals per day).

Anthropometric measurements (weight, height and MUAC) of the children was measured to determine their nutritional status. These anthropometric measurements were compared to the WHO reference standards to determine the nutrition status of the child.

Developmental assessments were done by TDSC chart and full systemic and neurological examination was performed.

Laboratory variables were complete blood counts measured by automated counter. The levels of vitamin B12 and folic acid were measured by chemiluminiscence method. In accordance with WHO guidelines, Vit B12 deficiency was defined as serum vitamin B12 concentration <203 pg/ml, folate deficiency when serum folate concentration was <3 ng/mL and iron deficiency when serum iron was <50ug/dl or Serum ferritin concentration <12 ng/ml.⁷⁻¹⁰

Statistical analysis

Demographic profile, anthropometry, laboratory data, developmental milestones of and micronutrient deficient were analyzed by using Standard software of biostatistics (SPSS version 21).

RESULTS

In this study, 50 children were enrolled (male 22 and female 28). Maximum numbers of children (50%) were in the age group 7-12 months. Higher numbers of the affected boys (22%) and affected girls (28%) were in the age group 7-12 months (Table 1).

Table 1: Age wise distribution of study population.

Age (month)	Male (n= 22)	Female (n=28)	Total (n=50)
0-6	2 (4)	4 (8)	6 (12)
7-12	11 (22)	14 (28)	25 (50)
13 -18	4 (8)	4 (8)	8 (16)
19-24	5 (10)	6 (12)	11 (22)

P value- 0.93 (NS) mean- 13.88

Table 2: Baseline characteristics of 50 children with delayed milestone.

Characteristic	Children
Socioeconomic	
BPL	31(62%)
APL	19 (38%)
Nutritional status (wt/ht in SD)	
Median to +1	8 (16%)
-1 to median	15 (30%)
-1 to -2	27 (54%)
Initiation of breast feeding (in Hr)	
< 1Hr	10 (20%)
1-2 Hr	14 (28%)
2-6 Hr	19 (38%)
6-12 Hr	4 (8%)
>12 Hr	3 (6%)
Feeding pattern in <6-month age	
EBF	32 (64%)
BF+ top milk feeding	18 (36%)
Complimentary feeding after 6 month age (age of introducing)	
At 6 month	2 (4.2%)
6-9 month	4 (8.5%)
9-12 month	14 (29.8%)
12-18 month	3 (6.4%)
18- 24 month	0 (0%)
No complimentary feeding	24 (51.1%)
Amount of complimentary feeding (calories intake)	
Adequate for age	6 (26.09%)
Inadequate for age	17 (73.91%)
Clinical features	
Pallor	38 (76%)
Hair changes	41 (82%)
Skin changes	35 (70%)

Sixty two percent patients were from below poverty line (BPL) families. Majority of the children (54%) had Wt/ Height -1 to -2 SD on WHO reference standards.¹¹ Feeding within 1 hour was started in 20% patients only. Sixty four percent children were exclusively breast fed up

to six month of age, in the rest top milk feeding was also given along with BF. In 24 out of 47 children (51.1%) in the age group of 6 months to 2 years no complimentary feeding was started, in the remaining in whom complimentary feeding was started the amount was inadequate in the majority (73%). Complimentary feeding was begun at the age of 9-12 month in 28%. The common clinical feature was Pallor (76%), hair changes (82%), skin changes (70%) along with delayed development (Table 2).

Table 3: Micronutrient deficiency in study group and controls.

	Study population (n=50)	Control group (n=50)	P value
Iron deficiency	33 (66%)	3 (6%)	<0.001
Folic acid deficiency	8 (16%)	0	<0.001
Vit B12 deficiency	39 (78%)	5 (10%)	<0.001

In this study most of children were vit B12 deficient (78% v/s 10% in control), followed by iron deficiency (66% v/s 6% in control) and folic acid deficiency (16% v/s nil in control). All the three micronutrients were deficient in significant number as compared to control (p value <0.001) (Table 3).

Table 4: Range of micronutrient levels.

Micronutrient level	Median	Mean (±SD)	Range
Folate (ng/ml)	8	8.59 5.22	2.6-22
Iron (mcg/ dl)	40.15	59.24 52.95	20-294.30
Vit. B12 (pg/ml)	102.2	185.13 205.73	<50-840
Ferritin (ng/ml)	61.5	55.31 38.78	5.8-148.3

Median value of Iron and vitamin B12 in study population was 40.15ug/dl and 102.2pg/ml which were lower than the cutoff of value whereas median value of Folate and ferritin were higher than cut off values (Table 4).

DISCUSSION

In present study majority of children (62%) with developmental delay were from poor socioeconomics (BPL) families. Micronutrient deficiencies represent a major challenge to child health in many low- and middle-income countries and may be associated with suboptimal cognitive function.¹²

In 38% percent children breast feeding was initiated late (2-6 hr) and 64% were exclusively breast fed up to six month of age, in the rest top milk feeding was also given along with BF. In present study population no complimentary feeding was started in time in 51.1%

children, in 73% of those in whom complimentary feeding was started the amount was inadequate. In 29.8% children complimentary feeding was started between 9-12 months of age followed by 6-9 month in 8.5%.

Yaikhomba et al studied on assessment of iron, folate and vitamin B12 status in severe acute malnutrition.¹³ They found that 88% children in age group 6-12 months were exclusive breastfed followed by 23% in age group 13-24 months. Most of hematopoietic factor deficient children were exclusively breastfed with 66.67% ferritin deficiency, 52.94% serum vitamin B 12 deficiency and 33.33% folate deficiency.

Rajpoot KS et al studied on assessment of iron, folate and vitamin B12 status in children aged 6 months to 2 years with infantile tremor syndrome.¹⁴ They also found that significantly higher numbers of patients (68%) were exclusively breastfed. Significant number of patients with vitamin B12 deficiency (62.8%) were exclusively breastfed. None of the child was found to be having folate and ferritin deficiency.

Torsvik IK et al reported prolonged exclusive breastfeeding may not provide sufficient B vitamins for small infants, and that this may have a negative effect on early gross motor development.¹⁵ infants who were exclusively breastfed for >1 month had lower B vitamin levels at all assessments and higher tHcy and MMA levels at 4 and 6 months. At 6 months, these infants had lower AIMS scores (p=0.03) and ASQ gross motor scores (p=0.01).

Authors found low serum vit. B12 in 78% of children with developmental delay whereas iron and folic acid deficiencies were seen in 66% and 16% patients respectively.

Sally Grantham-McGregor Cornelius Ani et al reviewed the effect of iron deficiency on children's cognition and behavior.¹⁶ Most correlational studies have found associations between iron-deficiency anemia and poor cognitive, motor development and behavioral problems.

Folate concentration in breast milk are generally high and independent of maternal stores thus prolonged breastfeeding in most of our patients might be protective from folate deficiency.^{16,17}

Shaahmadi F et al also reported significant relations between developmental delay with child nutrition (152 out of 210 exclusive breast feeding) and the mother's education level (10 illiterate, 105 diploma and underdiploma and 95 diploma and above).¹⁸

CONCLUSION

Micronutrient deficiency can have negative effect on milestone achievement. Micronutrient deficiency is strongly related to poor socioeconomic status of the

families and infant's diet and has a clear association with adverse developmental consequences. This deficiency is eminently preventable by simple measures like timely introduction of complimentary feeding, micronutrient supplementation to the infant, food fortification and dietary modification. These facts have implications for millions of children in the developing world.

The study is done on 50 patients and 50 control children and on the basis of this number status of whole communities can't be expressed.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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