

Article

Growth faltering in early infancy and its association with morbidity and mortality: a hospital-based, longitudinal study in Kolkata, West Bengal

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Abstract: Introduction: Under-five mortality rate in India has been steadily decreasing but still the contribution of malnutrition to child deaths is quite high. Despite decades of nutritional interventions, Out of 1.04 million fewer than five children mortality in India the year 2017, almost 706,000 were malnourished till date.

Aim: To estimate the proportion of infants aged 1-6 months with growth faltering and their severity, to examine the association of grades of anthropometric failure, feeding practices, background characteristics and severity of morbidity of infants aged 1-6 months with mortality.

Materials and method: The present study was a hospital-based, observational, descriptive study. This Study was conducted from 18 months at Department of Pediatric Medicine of College of Medicine and Sagore Dutta Hospital, Kolkata-700058 in West Bengal. Total 83 patients were included in this study.

Result: It was observed in present study that 4 in every 10 infant aged less than 6 months admitted in hospital were underweight including 1/10th severe underweight. In our study, 3 in every 10 infant had stunting including 1/10th severe stunting. It was observed that 5 in every 10 infant aged less than 6 months admitted with ARI in hospital were underweight including 2/10th severe underweight. In Severely wasted group, 5 (10.4%) patients had Early initiation of Breastfeeding Which was statistically significant ($p=0.0090$). In our study number of patients had Up to date Immunization status was [49(100)] which was statistically significant ($p=0.0056$). It was observed that infants aged 1-6 months with Night feeding in Severely underweight group were 5 (10.4%) infants which was statistically significant ($p=0.0258$).

Conclusion: Present study showed that growth faltering in early infancy was associated with morbidity and mortality.

Keywords: Growth Faltering; Feeding practices; Early Infancy; Morbidity and mortality.

1. Introduction

Under-five mortality rate in India has been steadily decreasing but still the contribution of malnutrition to child deaths is quite high. Despite decades of nutritional interventions, Out of 1.04 million fewer than five children mortality in India the year 2017, almost 706,000 were malnourished till date. However worldwide some 8.5 million infants under 6 months of age are malnourished, while the prevalence in India estimated at 14.8%; As per National Family Health Survey (NFHS-4), and World Health Organization (WHO), severe acute malnutrition in an infant less than 6 month of age had higher risk of mortality and long term adverse effect on health and well-being than their older counterpart.

As per NFHS-4, 35.8% of under-five children were underweight, 21.0% were wasted and 7.5% were severely wasted in India. The corresponding figures for West Bengal were 31.6%, 20.3%, and 6.5% respectively.

As per NFHS-4 data in West Bengal the prevalence of wasting and underweight among infant below 6 month of age were 24.0% and 19.4% respectively. The current infant mortality rate of West Bengal is 22 per 1000 live birth. As nutrition factors account for around 45% of child mortality rate, it is imperative to play focus on nutrition to reduce infant mortality further. Nutritional factor plays important role in mortality of infant under 6 month of age.

The first 1000 days of life that includes the period of 1-6 months is the most crucial period of life in relation to childhood nutrition. The mother's milk is the only source for optimum nutrition for the first six month. Breast milk is more than just food – it is a potent medicine tailored to the needs of each child. Exclusive breastfeeding is the safest and healthiest option for children everywhere. Long periods of breastfeeding are associated with higher intelligence scores, and there is evidence that this translates into improved academic performance and long-term earnings. There is growing evidence that breastfeeding may also reduce the incidence of overweight, obesity and chronic diseases later in life. Reducing malnutrition early is associated with reduction of morbidities, mortality in short term and optimum health, growth and development in long term. So, identifying nutritional at-risk infants below six months of age i.e. having growth failure in this age group and managing them effectively are the needs of the hour.

Malnutrition refers to deficiencies or excesses in nutrient intake, imbalance of essential nutrients or impaired nutrient utilization. The double burden of malnutrition consists of both under nutrition and overweight and obesity, as well as diet-related non-communicable diseases. Under nutrition manifests in four broad forms: wasting, stunting, underweight, and micronutrient deficiencies.

2. Material and methods

2.1. Study type

It was a hospital-based, observational, descriptive study.

2.2. Study design

The present study is planned to be a prospective study with longitudinal design.

2.3. Study Setting

The study was conducted in the In-patients Wards of Department of Pediatric Medicine of College of Medicine and Sagore Dutta Hospital, Kolkata-700058 in West Bengal.

2.4. Duration

The total duration of the study was 18 months; Six months for preparatory work at the beginning and data analysis and report writing at the end and 12 months for collection of data.

2.5. Study population

Infants of 1-6 month of age with a range of medical complains like sepsis, pneumonia, diarrhea and other illnesses and admitted in pediatric ward of College Of Medicine And Sagore Dutta Hospital was the study population. They was screened for growth faltering i.e. having a Z score < -2 in any of the Weight for Age (WAZ), Weight for Length (WLZ), Length for Age (LAZ) and having Mid Upper Arm Circumference (MUAC) < 125 mm with growth faltering (< - 2 S.D.) in any of the Weight for Age (WAZ), Weight for Length (WLZ), Length for Age (LAZ) and having Mid Upper Arm Circumference (MUAC) < 125 mm. As the neonates (0-1 month) are treated in Sick Newborn Care Unit (SNCU), they will not be included in the study. All infants whose legal guardian will give consent to participate in survey was included in the study.

2.6. Inclusion criteria

1. Age 1-6 month.
2. Severely acute malnourished.
3. Consented to participate in survey by the guardian.

2.7. Exclusion criteria

1. Infants with major physical or congenital deformity (e.g. Paralysis, cerebral palsy).
2. Infants with chronic systemic illness including congenital heart diseases, haemolytic anemia, HIV, tuberculosis, cancer, liver disease, and renal disease.

3. Results

The present study was a hospital-based, observational, descriptive study. This Study was conducted from 18 months at Department of Pediatric Medicine of College of Medicine and Sagore Dutta Hospital, Kolkata-700058 in West Bengal. Total 83 patients were included in this study.

Chowdhury A *et al.* [1] observed that young children living in urban slums are at high risk for acute malnutrition and stunting. The prevalence of wasting (W/H) was found in 48.9% of the population in this study, of which 25.0% had severe acute malnutrition (SAM) and 23.9% had moderate acute malnutrition (MAM).

We observed that, higher number of patients were underweight in Moderate group [26 (31.32%)] compared to Severe group [9 (10.84%)] but this was not statistically significant ($p=0.4635$). It was observed in present study that 4 in every 10 infant aged less than 6 months admitted in hospital were underweight including 1/10th severe underweight.

In our study, 3 in every 10 infant aged less than 6 months admitted in hospital had stunting including 1/10th severe stunting. It was also found that, 4 in every 10 infant aged less than 6 months admitted in hospital had wasting including 1/10th severe wasting. In our study, majority number of patients were Stunting with ARI in Moderate group [9(42.85%)] compared to Underweight in Severe group [5 (23.80%)] though it was not statistically significant ($p=0.3332$).

Gupta P *et al.* [2] examined that to compare the physical growth outcomes, morbidity profile and mortality at an age of 12 months among late preterm (340/7 to 366/7) neonates to term (370/7 to 416/7) neonates. The median (IQR) episodes per baby for late preterms as compared to terms for diarrhea [1.84 (0,3) vs 1.14 (0,2) ($P <0.001$)] Deichsel E *et al.* [3] showed that diarrhea and poor linear growth are leading causes of childhood morbidity and mortality in low- and middle- income countries. We showed that, more number of patients were Stunting with Diarrhea in moderate group [6(60%)] which was not statistically significant ($p=0.8170$).

Deichsel E *et al.* [3] showed that diarrhea and poor linear growth are leading causes of childhood morbidity and mortality in low- and middle- income countries. Infant and maternal illness, including diarrhea, were ascertained at monthly study visits and sick visits.

It was found that, most number of patients were Wasting with Chronic Illness in moderate group [7 (53.84%)] compared to Severe group [3 (23.07%)] but this was not statistically significant ($p=0.9468$).

Chowdhury A *et al.* [1] observed that young children living in urban slums are at high risk for acute malnutrition and stunting. The prevalence of wasting (W/H) was found in 48.9% of the population in this study, of which 25.0% had severe acute malnutrition (SAM) and 23.9% had moderate acute malnutrition (MAM). We observed that, majority number of patients were underweight with other illness in moderate group [18 (46.15)] compared to wasting with other illness in Severe group [8 (20.51)] which was not statistically significant ($p=0.7195$).

Verma R *et al.* [4] found that every day, on an average more than 26000 children under the age of five die around the world. There is no relation found between, exclusive breastfeeding practices and wasting, underweight but related with growth and stunting among the study infants. Park JJ *et al.* [5] examined that the first 1000 days of life represent a critical window for child development. Pregnancy, exclusive breastfeeding (EBF) period (0-6 months), and complementary feeding (CF) period (6-24 months) have different growth requirements, so separate considerations for intervention strategies are needed.

In our study, higher number of patients had Early initiation of Breastfeeding in moderate underweight group [5 (10.41%)] and though it was not statistically significant ($p=2.1779$). We found that, 7 (14.58%) patients had Early initiation of breastfeeding with underweight in moderate Stunting group but this was not statistically significant ($p=0.4635$). In our study, majority number of patients had Early initiation of Breastfeeding with underweight in moderate wasting group [18 (16.6%)] compared to Severe wasting group [5 (10.4%)] which was statistically significant ($p=0.0090$).

Gupta P et al. [2] examined that to compare the physical growth outcomes, morbidity profile and mortality at an age of 12 months among late preterm (340/7 to 366/7) neonates to term (370/7 to 416/7) neonates. Feeding difficulties, jaundice and re-hospitalization rates were significantly higher in the late preterm group. Von Salmuth V et al. [6] found that small and nutritionally at-risk infants under 6 months (<6m) are a vulnerable group at increased risk of mortality, morbidity. They aimed to inform future guidelines by exploring the impacts of maternal-focused interventions on infant feeding and growth. We showed that, higher number of patients had Night feeding in moderate Underweight group [19 (24.3%)] compared to Severe Underweight group [5 (10.4%)] but this was statistically significant ($p=0.0258$).

Our study showed that, more number of patients had Night feeding in moderate Stunting group [12 (15.3%)] compared to Severe Stunting group [8 (10.3%)] which was statistically significant ($p=0.0017$).

Motil KJ et al. [7] observed that poor weight gain, also called "weight faltering," "faltering growth," or "growth deficit," refers to failure to gain weight appropriately; in more severe cases, linear growth and head circumference also may be affected.

In our study, lower number of patients had Bottle feeding in Severe Underweight group [4 (8.9%)] compared to moderate Underweight group [23 (51.1%)] but this was not statistically significant ($p=0.5087$). and We found that, lower number of patients had Bottle feeding in Severe Stunting group [4 (8.9%)] compared to moderate Stunting group [20 (44.4%)] though it was not statistically significant ($p=0.5749$). We showed that, higher number of patients had Bottle feeding in moderate Wasting group [20 (44.4%)] compared to Severe Wasting group [4 (8.9%)] which was not statistically significant ($p=0.3307$).

Our study showed that, higher number of patients had Mixed feeding in moderate Underweight group [21 (42%)] compared to Severe under weigh group [6 (12%)] which was not statistically significant ($p=0.2844$). In our study, majority number of patients had Mixed feeding in moderate Stunting group [19 (38%)] compared to Severe Stunting group [4 (8%)] but this was not statistically significant ($p=0.4221$). We found that, higher number of patients had Mixed feeding in moderate Wasting [11 (22%)] compared to Severe Wasting group [8 (16%)] though it was not statistically significant ($p=0.8785$). We observed that, majority number of patients had Prolactal feeding in moderate Underweight group [16 (42.1%)] compared to Severe Underweight group [7 (18.4%)] which was not statistically significant ($p=0.2284$). Our study showed that, higher number of patients had Prolactal feeding in moderate Stunting group [15 (39.5%)] compared to Severe Stunting group [7 (18.4%)] which was not statistically significant ($p=0.4706$).

Verma R et al. [4] found that every day, on an average more than 26000 children under the age of five die around the world. There is no relation found between, exclusive breastfeeding practices and wasting, underweight but related with growth and stunting among the study infants. Gonzales GB et al. [8] examined that growth faltering in children arises from metabolic and endocrine dysfunction driven by complex interactions between poor diet, persistent infections. They observed that measures of stunting, wasting, and underweight are dynamically associated with each other and that lipid groups containing. In our study, majority number of patients had Prolactal feeding in moderate Wasting [14 (36.8%)] compared to Severe Wasting group [5 (13.1%)] but this was not statistically significant ($p=0.5104$).

We found that, higher number of patients had Severe Morbidity [7.9] followed by Non-severe [2.45], we showed that, majority number of patients had Severe Underweight [4.6] followed by Moderate Underweight [3.8], we observed that, Severe Stunting [5.78] was higher than Moderate Stunting [3.21] and in our study, Severe Wasting [5.95] was higher than Moderate Wasting [2.5] which was not statistically significant ($p=0.3517$).

Our study showed that, Distubution of study population according to grades of underweight was not statistically significant ($p=0.5104$). Deichsel E et al. [3](2018) showed that diarrhea and poor linear growth are leading causes of childhood morbidity and mortality in low- and middle- income countries. Greater declines in LAZ were associated with household crowding and neonatal pneumonia, while higher maternal education and height were associated with greater gains in LAZ.

Our study showed that, majority number of mothers of 1-6 year aged children were Household worker in without mortality group [5(100)] but this was not statistically significant ($p=0.2606$). Von Salmuth V et al. [6] found that small and nutritionally at-risk infants under 6 months (<6m) are a vulnerable group at increased risk of mortality, morbidity, poor growth and sub-optimal development. Antenatal supplementation with macronutrient, multiple micronutrients, Vitamin D, zinc, iron folic acid and possibly calcium, iodine and B12 in deficient women, improved birth outcomes.

Our study showed that, most of the patients had Antenatal visit 4 or more [56(100)] in without mortality and though it was statistically significant ($p=0.0013$). In our study, more number of patients had Up to date Immunization status [49(100)] in without mortality but this was statistically significant ($p=0.0056$). We found that, more number of patients were Upper lower class in without mortality [65(95.6)] compared to with mortality [3(4.4)] but this was not statistically significant ($p=0.3140$). In our study, higher number of patients had severe under nutrition, Growth velocity in Therapeutic intervention [12(75)] compared to Moderate under nutrition, Growth velocity in Standard care [8(61.5)] which was statistically significant ($p=0.0469$).

Table 1. In hospital mortality rate

Variable	Categories	Mortality Rate per 1000 child-days
Total		10.35
Underweight	No (n=48)	2.21
	Moderate (n=26)	3.8
	Severe (n=9)	4.6
Stunting	No	1.36
	Moderate	3.21
	Severe	5.78
Wasting	No	1.9
	Moderate	2.5
	Severe	5.95

Mortality = Total no. of deaths/ child-days under supervision* 1000

Table 2. Distribution of infants aged 1-6 months according to early initiation of breastfeeding and grades of underweight, stunting and wasting

		underweight			χ^2 for linear trend (p value)	Chi-square Value	P value
		No	moderate	Severe			
Early initiation of Breastfeeding	Yes	43 (89.58)	5 (10.41)	0	<0.05	30.6794	<0.05
	No	11 (31.4)	20 (57.1)	4 (11.4)			
Stunting							
Early initiation of Breastfeeding	Yes	41 (85.41)	7 (14.58)	0	<0.05	19.84	0.4635
	No	15 (42.8)	12 (34.3)	8 (22.8)			
Wasting							
Early initiation of Breastfeeding	Yes	35 (72.9)	8 (16.6)	5 (10.4)	<0.009	9.4161	<0.009
	No	14 (40)	15 (42.8)	6 (17.1)			

Table 3. Morbidity of 1-6 months aged children according to antenatal visits and immunization status

		Death	Alive
Antenatal visit	0	5(20.8)	19(79.2)
	2	0	10(100)
	3	0	5(100)
	4 or more	0	56(100)
Immunization status	Up to date	0	49(100)
	Not completed	5(14.7)	29(85.3)

4. Conclusion

It was observed in present study that 4 in every 10 infant aged less than 6 months admitted in hospital were underweight including 1/10th severe underweight. In our study, 3 in every 10 infant aged less than 6 months admitted in hospital had stunting including 1/10th severe stunting. It was also found that, 4 in every 10 infant aged less than 6 months admitted in hospital had wasting including 1/10th severe wasting. It was observed in present study that 5 in every 10 infant aged less than 6 months admitted with ARI in hospital were underweight including 2/10th severe underweight. It was observed in our study that 2 in every 10 infant aged less than 6 months admitted with ARI in hospital had stunted including 1/10th severe stunting. It was found in present study that 5 in every 10 infant aged less than 6 months admitted with diarrhea in

hospital were underweight including 1/10th severe wasting. It was observed in present study that 6 in every 10 infant aged less than 6 months admitted with diarrhea in hospital had stunting. In our study we found that 6 in every 10 infant aged less than 6 months admitted with diarrhea in hospital had wasted including 1/10th severe wasting. In our study, higher number of patients had early initiation of Breastfeeding. We found that, 7 patients had early initiation of Breastfeeding in Stunted group but which was not statistically significant and in our study, majority number of patients had early initiation of Breastfeeding in wasted group which was statistically significant. We showed that, higher number of patients had Night feeding in Underweight group and Our study showed that, more number of patients had Night feeding in Stunted group which was statistically significant. In our study, lower number of patients had Bottle feeding in Underweight group . We found that, lower number of patients had Bottle feeding in Severely Stunted group which was not statistically significant. Our study showed that, higher number of patients had mixed feeding in Underweight group we found that, higher number of patients had mixed feeding in wasted group but these were not statistically significant. We observed that, majority number of patients had prelacteal feeding in Underweight group. In our study, majority number of patients had prelacteal feeding in wasted group but this was not statistically significant. Our study showed that, most of the patients had antenatal visit 4 or more which was statistically significant. In our study, more number of patients had Up to date Immunization status which was statistically significant.

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Conflicts of Interest: The authors declare that they do not have any conflict of interests.

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