ORIGINAL ARTICLE

Study of maternal and infant factors affecting under nutrition in less than six months

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ABSTRACT

Background: Under nutrition in infants is a critical public health concern with irreversible consequences on child growth and development, particularly during the crucial first six months of life. Maternal under nutrition has been associated with poor fetal growth which may result in low birth weight. **Aims & Objectives**: To understand the clinical profile and management of under nutrition in less than six months. This study also aims to explore various factors of under nutrition in infants less than 6 months of age, identifying key factors that contribute to the problem and proposing practical solutions to address it. **Methodology**: This observational cross-sectional study was carried out in a tertiary care hospital with sample size of 194 infants.The pre validated questionnaire and structured proforma were used. **Results**: The infants aged between 0 and 6 months (average age 2.7± 1.5 months), of 194 infants studied,70.1% required NICU admissions,15.5% had congenital anomalies, 69.6% had weight for age, 39.2% length for age and 46.9% Head Cercumference for age Below -3 standard deviations and Weight for length <-3SD was observed in 57% of infants. **Conclusion**: Maternal parity, consanguineous marriages, and lower socioeconomic status shown to be associated with the congenital anomalies and low birth weight.

KEYWORDS

Neonatal; Infant, Low Birth Weight; Fetal Growth Retardation; Growth and Development

INTRODUCTION

Under nutrition in infants causes irreversible damage to child growth and development during the critical first six months of life (1). Any disruption in adequate nutrition in this critical period can lead to stunted growth, compromised immune function, and impaired cognitive development (2). The infant under nutrition also lead to 2.2 million deaths annually and 21% of disability-adjusted life-years (3).The Global Nutrition Report 2019 of United Nations Children's Fund (UNICEF) reports more than 47 million children undernourished (4). Additionally, poor infant nutrition during their first month of life lead to 40% of deaths in children under five years (5). The adverse effects of infant under nutrition include disabilities (6), poor school performance, diabetes and cardiovascular disease which may affect future generations (5,7,8).

Maternal under nutrition has been associated with low birth weight (LBW), small for gestational age (SGA), and preterm birth (PTB). Understanding the clinical profile of under nutrition in less than six months requires a comprehensive approach, (11-15).

This study aims to explore

- Various factors of under nutrition in infants less than 6 months of age
- Maternal factors affecting under nutrition in less than six months
- The research aims to develop strategies which can guide in community-based interventions.

MATERIAL & METHODS

Study type, study design & study setting: This observational cross-sectional study was conducted at a tertiary care centre in Western Maharashtra during the period of two years.

Study population: All infants aged less than 6 months with under nutrition who visited to the pediatric outpatient and admitted in hospital.

Study duration : 2 years

Sample size Calculation: The sample size was determined based on a reported prevalence of malnutrition in infants under 6 months as 14.8%(16), With a 95% confidence interval and an acceptable difference of 5%, the estimated sample size was 194. Infants were screened for under nutrition and the children aged 20 days to 6 months who visited to the pediatric outpatient and admitted in hospital and whose parents or guardians provided written and informed consent for the participation of their child in the study were enrolled by convenient sampling.

Exclusion criteria: Not willing to participate in the study were excluded

Strategy for data collection: Visit to Immunization clinics, OPD and in patient wards.

Working definition: infants aged less than 6 months with under nutrition as per WHO charts (ref).

Ethical issues & informed consent: Approval from the Institutional Ethics Committee was obtained prior to the start of the study (Ref.no.: I.E.S.C./296/2022) dated 12/11/2022. Written informed consent was obtained from the parents or guardians of each participant before data collection. Photograph was taken with the parent's consent. Children within the age range of 20 days to 6 months were examined using a structured pro forma. Mothers were assessed using a pre validated questionnaire to collect information on maternal factors.

Data analysis – software: Data collection included a structured assessment and clinical proforma of the child and the mother. Maternal Information included- socio-demographic (age, religion, education level, consanguinity socioeconomic status), obstetric (parity, antenatal check-up frequency, and ultrasound scans), anthropometric (weight in kg, height in centimetre and weight gain during pregnancy), Biochemical (haemoglobin and thyroid levels during pregnancy), and other mental health status, co morbidities, prior medication, dietary history and supplements taken during pregnancy. Infant information included, gestational age, birth weight,sex, mode of delivery, initiation of breastfeeding, exclusive breastfeeding status, associated illnesses, growth chart, and milestone records, anthropometric measurements (weight, length, MUAC at the time of enrolment). The values represented in the tables are mean+/-SD for quantitative variables and frequency (%) for qualitative variables.

Statistical analysis: Statistical analysis was conducted using MS Excel (Microsoft 365) and IBM SPSS Statistics for Windows, Version 27.0(IBM Corp. Released 2020. Armonk, NY: IBM Corp). Data was presented using Mean & Standard Deviation for the quantitative variables and frequency (percentage) for all the categorical variables. Normality assumption was checked using Shapiro-Wilk test.For normally distributed variables, mean differences between the two groups were compared using two samples t-tests and variables which are not normally distributed were analysed using Mann-Whiteney U test. Categorical variables were analysed using the Fisher's exact test. For all the tests, a p-value of <0.05 (two-tailed) was considered statistically significant.

RESULTS:

Table 1 &2 show the characteristics of the infants and mothers.Maternal and Infants Characteristics predicting infants NICU Admissions: A total of 136 (70.1%) of infants were admitted to the NICU after birth. Higher maternal BMI, the presence of co-morbid conditions such as preeclampsia and gestational diabetes (GDM), and delivery by cesarean section have been linked to an increased likelihood of infants requiring NICU admission. Additional factors include primiparity, consanguineous marriages, and lower-middle socioeconomic status.

Table 1: Characteristics- babies (n=194)

Characteristics- babies (n=194)	Descriptive Statistics
Sex	
Female	70 (36.1%)
Male	124 (63.9%)
Preterm	78 (40.2%)
Term	116 (59.8%)
Congenital anomalies	30 (15.5%)
NICU admission	
Yes	136 (70.1%)
MUAC (cm)	
<11	103 (53.1%)
Head circumference (cm)	37.13 ± 2.48
Length for age	
Less than -3SD	76 (39.2%)

Characteristics- babies (n=194)	Descriptive Statistics
Weight for age	
Less than -3SD	135 (69.6%)
Weight for length	
Less than -3SD	111 (57.2%)
-3 to -2 SD	80 (41.2%)
-2 to -1 SD	2 (1.0%)
-1 to 0 SD	1 (0.5%)

Table 2: Characteristics- Mothers (n=194)

Characteristics- Mothers (n=194)	Descriptive Statistics
General and clinical	
mother's age (in years)	25.98 ± 4.16
Parity (Primipara)	91 (46.9%)
Consanguinity (yes)	57 (29.4%)
Weight gain during pregnancy (kg)	9.48 ± 2.45
Co-morbidities (yes)	53 (27.3%)
Mode of delivery	
Normal vaginal	72 (37.1%)
LSCS	122 (62.9%)
BMI (KG/M2)	22.42 ± 3.42
Haemoglobin (in third trimester)	10.32 ± 1.25
Thyroid status (abnormal)	9 (4.6%)
Initiation of breast feeding within 1 hr	30 (15.5%)
Excusive breast feeding (yes)	116 (59.8%)

Table 3: Association of NICU Admissions with Mother's Characteristics

Characteristics- Mothers (n=194)	NICU Admission	Not admitted to NICU	p-value
	136 (70.1%)	58 (29.9%)	
mother's age (in years)	26.12 ± 4.20	25.64 ± 4.08	0.558
Parity (Primipara)	67	24	0.009*
Consanguinity (yes)	47	10	0.001*
Sociodemographic status			
1. Lower	36	30	<0.001*
2. Lower middle	83	27	
3. Middle	17	1	
Weight gain during pregnancy (kg)	9.50 ± 2.18	9.41 ± 3.00	0.356
Co-morbidities (yes)	44	9	0.001*
Mode of delivery			
Normal vaginal	38	34	<0.001*
LSCS	98	24	
BMI (KG/M2)	21.99 ± 3.18	23.43 ± 3.78	<0.001*
MUAC (cm)	24.85 ± 1.90	25.03 ± 2.40	0.93
Biochemical			
Haemoglobin	10.21 ± 1.10	10.59 ± 1.51	0.011*
Thyroid status (abnormal)	8	1	0.001*
Post-partum			
Initiation of breast feeding within 1 hr	8	22	<0.001*
Excusive breast feeding (yes)	72	44	<0.001*

*Values represented are mean±SD for quantitative variables; test used: Mann-Whiteney U test and frequency (%) for qualitative variables; Test used: Fisher's Exact test. *p-value of <0.05, statistically significant.*

Infants with low birth weight, male gender and prematurity have shown to be associated with the admission to the NICU. Infants admitted to the NICU after birth had low BMI, less MUAC and head circumference at enrollment (at an average age of 2.7 months). Additionally, these infants exhibited delays in growth, as indicated by a significantly higher percentage having measurements below 3 standard deviations for length-for-age, weight-for-age, head circumference-for-age, and weight-for-length (Table 4).

Table 4: Association of NICU Admissions with Babies Characteristics

Characteristics- babies (n=194)	NICU Admission 136 (70.1%)	Not admitted to NICU 58 (29.9%)	p-value
Birth weight (kg)	2.02 ± 0.61	2.69 ± 0.38	<0.001*
Female	47	23	0.023*
Male	89	35	
·Preterm	72	6	<0.001*
·Term	64	52	
Congenital anomalies			
·Yes	19	11	0.010*
·No	117	47	
Weight (kg)#	3.46 ± 1.18	4.54 ± 1.20	<0.001*

Characteristics- babies (n=194)	NICU Admission 136 (70.1%)	Not admitted to NICU 58 (29.9%)	p-value
MUAC (cm)			
<11	82	21	<0.001*
Head circumference (cm)	36.59 ± 2.38	38.38 ± 2.27	<0.001*
Length for age			
Less than -3SD	63	13	<0.001*
Weight for age			
Less than -3SD	113	22	<0.001*

Table 5: Maternal and Infants Characteristics predicting congenital anomalies

Characteristics- Mothers (n=194)	Congenital Anomalies Present	Congenital Anomalies Absent	p-value
	164 (84.5%)	30 (15.5%)	
General and clinical			
mother's age (in years)	25.30 ± 3.91	26.10 ± 4.20	0.327
Parity (Primipara)	17	74	0.008*
Consanguinity (yes)	9	48	0.014*
Sociodemographic status			
1. Lower	14	52	0.018*
2. Lower middle	13	97	
3. Middle	3	15	
Weight gain during pregnancy (kg)	10.07 ± 3.48	9.37 ± 2.20	0.84
Co-morbidities (yes)	8	45	0.014*
Mode of delivery			
Normal vaginal	12	60	0.037*
LSCS	18	104	
Anthropometric			
BMI (KG/M2)	23.05 ± 4.14	22.30 ± 3.28	0.756
MUAC (cm)	25.52 ± 2.58	24.79 ± 1.93	0.248

Congenital anomalies were present in 30 (15%) of the infants. Maternal size measurements including BMI, the presence of co-morbid conditions and mode of delivery did not showed association with congenital anomalies in infants. Maternal parity (primips), consanguineous marriages, and lower socioeconomic status shown to be associated with the congenital anomalies (Table 5). Infants with congenital anomalies had low birth weight and prominently male gender. At enrolment (an average age of 2.7 months) these infants had higher size measurements including BMI and MUAC, though the head circumference was similar to those without congenital anomalies.

DISCUSSION

This study provides a comprehensive analysis of the clinical profile, etiology, and management of undernutrition in infants under six months of age. The findings are crucial for understanding the multifaceted aspects of infant health, particularly in a clinical setting, and offer valuable insights into improving nutritional outcomes for this vulnerable population. The assessment of infant length in the present study showed that a notable percentage also fell below the standard deviation for their age, suggesting stunted growth. Assessing the growth parameters of the children, 48 of them have lengths between -2 and -3 standard deviations, suggesting mild to moderate growth delay. Furthermore, 70 children exhibit lengths below -3 standard deviations, indicating severe growth impairment within this age group. Zysman-Colman Z et al. (2022) analyzed a large dataset of 163,482 anthropometric measurements from 12,640 individuals and found that 16.8% of infants exhibited discordant under nutrition status at age 2 months (17). This discordance decreased with age, becoming less common (1.5%-10%) as infants grew older. Their study highlighted that length-for-age z-scores (LAZ) were lower in group 2 compared to groups 1 and 3 between birth and 24 months, suggesting that certain subgroups of infants are more prone to stunted growth ($P < .05$). Furthermore, they found that the odds of weight-for-length z-score (WFLZ)-defined under nutrition at 2 months were higher for shorter individuals (OR 1.5, CI 1.4-1.6, $P < .001$). Additionally, 134 children exhibit weights that are more than 3 standard deviations below the mean, indicating a notable proportion of infants experiencing severe under nutrition based on standard deviation measures. The analysis of nutritional status using length-for-age, weight-for-age, and head circumference-for-age z-scores revealed that a substantial proportion of infants were classified as malnourished. Infants aged 0-1 month exhibited the highest percentage of severe malnutrition across these parameters,

emphasizing the critical need for early nutritional interventions. Kerac et al. (2021) found that extreme values (flagged for malnutrition) were more common for length-based measures than for weight-based measures. Specifically, 6.1% of infants were flagged for weight-for-length and 4.8% for length-for-age, compared to only 1.0% for weight-for-age. This indicates that length-based measures might be more sensitive indicators of malnutrition in infants, aligning with our findings that a significant proportion of infants showed signs of stunted growth and undernutrition based on length-for-age z-scores. The consistency between our study and the findings of Kerac et al. reinforces the critical need for early identification and intervention for malnutrition(18). The higher prevalence of severe malnutrition in infants aged 0-1 month in our study highlights a particularly vulnerable period where immediate nutritional support is essential. The present study's findings are in line with Syeda B et al. (2021), emphasize the critical need for continuous monitoring of growth parameters and early interventions to prevent and manage stunted growth. Ensuring that infants receive adequate nutrition and healthcare support from an early age is crucial for their overall development and long-term health outcomes (19).Among the mothers of infants in this cohort, 67 mothers are experiencing inadequacy in breast milk production, while 127 mothers have sufficient milk supply. This distribution underscores the variability in breastfeeding experiences among mothers within the studied group. Supporting and promoting these practices among mothers is essential in enhancing breastfeeding success rates and addressing any challenges that may arise. By emphasizing the importance of proper attachment, effective suckling, and supportive feeding positions, healthcare providers can empower mothers to establish and maintain successful breastfeeding routines, thereby promoting the overall health and well-being of both mother and infant. Comparatively, a recent study by Patel et al. (2022) investigated breastfeeding adequacy and challenges in a similar population. Patel et al. reported that 65% of mothers perceived their breast milk to be adequate, which closely aligns with the 63.92% adequacy reported in our study. However, they also found that 35% of mothers experienced difficulties in maintaining exclusive breastfeeding due to issues such as perceived milk insufficiency, infant refusal to feed, and maternal return to work (20). In another recent study, Sharma et al. (2023) examined feeding practices and challenges among mothers of infants aged 0-6 months. Sharma et al. found that 60% of mothers reported adequate breast milk supply, but 40% faced challenges similar to those identified in our study, including infant refusal to feed and difficulties maintaining exclusive breastfeeding as infants aged. They emphasized the importance of continuous support and education for breastfeeding mothers to address these issues effectively (21).

CONCLUSION:

The study conducted to understand the clinical profile, etiology, and management of under nutrition in infants under six months of age has brought out various maternal and infant factors affecting under nutrition in less than six months. These include birth weight, growth parameters, congenital anomalies, neonatal intensive care admissions and breastfeeding practices. Maternal factors such as parity, inadequate weight gain during pregnancy were significant determinants of infant nutritional status, indicating the necessity for comprehensive maternal support programs

RECOMMENDATION:

The study recommends comprehensive approach to the management of under nutrition in less than six months which include holistic approach to mother infant dyad in preventing burden of under nutrition

LIMITATION OF THE STUDY

This is hospital based study so we could not study community based factors and management of under nutrition in less than six months.

RELEVANCE OF THE STUDY

The under nutrition in infants less than six months is a challenging and globally needs protocol and policy. This study can guide for facility based management protocols.

AUTHORS CONTRIBUTION

All authors have contributed equally.

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Nil

CONFLICT OF INTEREST

There are no conflicts of interest.

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DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors haven't used any generative AI/AI assisted technologies in the writing process.

REFERENCES

1. De Onis M. Child growth and development. Nutrition and health in a developing world. 2017:119-41.
2. WHO. Resolution WHA65.6. Maternal, infant and young child nutrition. In: Sixty-fifth World Health Assembly, Geneva, 21–26 May. Resolutions and decisions, annexes. World Health Organization: Geneva; 2012. https://iris.who.int/bitstream/handle/10665/80480/A65_R6-en.pdf Accessed on 12 Dec. 24
3. Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, Mathers C, Rivera J; Maternal and Child Undernutrition Study Group. Maternal and child undernutrition: global and regional exposures and health consequences. Lancet. 2008;371(9608):243-60.
4. World Health Organization, United Nations Children's Fund. Levels and trends in child malnutrition: key findings of the 2020 edition. UNICEF/WHO/World Bank Group joint child malnutrition estimates. World Health Organization; 2020 https://www.unicef.org/media/69816__/file/Joint-malnutrition-estimates-2020.pdf Accessed on 12 Dec. 24
5. Black RE, Victora CG, Walker SP, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet. 2013; 382(9890), 427–451.
6. Said-Mohamed R, Pettifor JM. Life history theory hypotheses on child growth: potential implications for short and long-term child growth, development and health. Am J PhysAnthropol. 2018;165(1),4–19.
7. Bouvier P, Papart JP, Wanner P, et al. Malnutrition of children in Sikasso (Mali): prevalence and socio-economic determinants. Sozial- Präventivmedizin SPM. 1995; 40(1), 27–34.
8. Victora CG, Adair L, Fall C, et al. Maternal and child undernutrition: consequences for adult health and human capital. Lancet (London, England). 2008; 371(9609), 340–357.
9. Richter LM, Orkin FM, Roman GD,et al. Comparative models of biological and social pthways to predict child growth through age 2 years from birth cohorts in Brazil, India, the Philippines, and South Africa. J Nutr. 2018; 148(8), 1364–1371.
10. Wrottesley SV, Lamper C, Pisa PT. Review of the importance of nutrition during the first 1000 days: maternal nutritional status and its associations with fetal growth and birth, neonatal and infant outcomes among African women. J Dev Orig Health Dis. 2016; 7(2), 144–162.
11. Lee AC, Katz J, Blencowe H, et al. National and regional estimates of term and preterm babies born small for gestational age in 138 low-income and middleincome countries in 2010. Lancet Glob Health. 2013; 1(1), e26–e36.
12. Black RE. Global prevalence of small for gestational age births. Nestle NutrInst Workshop Ser. 2015; 81, 1–7. 11.
13. Lee AC, Kozuki N, Cousens S, et al. Estimates of burden and consequences of infants born small for gestational age in low- and middle-income countries with INTERGROWTH-21st standard: analysis of CHERG datasets. BMJ. 2017;358,e26–e36.
14. Vachani JG, editor. Failure to Thrive and Malnutrition: A Practical, EvidenceBased Clinical Guide. Springer Nature; 2023.
15. Hunter PJ, Muthiani Y, Näsänen-Gilmore PK, Koivu AM, Pörtfors P, Bastola K, Vimpeli R, Luoma J, Ashorn U, Ashorn P. A modular systematic review of antenatal interventions to address undernutrition during pregnancy in the prevention of low birth weight. The American journal of clinical nutrition. 2023;117:S134-47.
16. Prevalence of wasting among under 6-month-old infants in developing countries and implications of new case definitions using WHO growth standards: a secondary data analysis
17. Marko Kerac 1, Hannah Blencowe, Carlos Grijalva-Eternod, Marie McGrath, Jeremy Shoham, Tim J Cole, Andrew Seal Zysman-Colman Z, Munsar Z, Sheikh S, Rubenstein RC, Kelly A. Infant body mass index or weight-for-length and risk of undernutrition in childhood among children with cystic fibrosis. The Journal of Pediatrics. 2022 Apr 1; 243:116-21.
18. Kerac M, James PT, McGrath MG, Brennan E, Opondo C, Frison S. Infant malnutrition in low-and middle-income countries: assessment and prevalence of small and nutritionally at-risk infants aged under 6 months in 54 Demographic & Health Survey datasets. Medrxiv. 2021 Dec 23:2021-12.
19. Majid A, Hussain Ms, Najar Ba, Tali Sh, Gulzar S. Clinical Profile And Outcome Of Children With Severe Acute Malnutrition Admitted At Nutritional Rehabilitation Center Of Mcch-Associated Hospital Of Gmc-Anantnag. Asian J Pharm Clin Res. 2023;16(1):61-4.
20. Patel A, Banerjee A, Kalita D, Singh A. Breastfeeding adequacy and challenges among lactating mothers: A cross-sectional study in urban India. Int Breastfeed J. 2022; 17:78.
21. Sharma P, Gupta R, Singh K. Feeding practices and challenges among mothers of infants aged 0-6 months: A community-based study. BMC Pediatr. 2023; 23:119.