DISSERTATION TRAINING

at

IIHMR DELHI

A REPORT ON

"Assessment of Nutritional Status among Children (0–2 Years) in Urban Slums of Delhi using Anthropometric Measurements."

By

MANEESH SHARMA

PG/24/052

Under the guidance of

Dr. Ratika Samtani

Post Graduate Diploma in Hospital and Health Management

2024-2026



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TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Maneesh Sharma** student of PGDM (Hospital & Health Management) from International Institute of Health Management Research, New Delhi, has undergone internship training at IIHMR From 11 March, 2026 to 10 June, 2026. The Candidate has successfully carried out the project designated to him during internship training, and his/her approach to the study has been sincere, scientific, and analytical. The Internship is in fulfillment of the course requirements.

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The certificate is awarded to

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Date: 3rd June 2026

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his comes across as a committed, sincere & diligent person who has a strong drive & zeal for learning. We wish him all the best for future endeavors.

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The following dissertation titled **"Assessment of Nutritional Status among Children (0–2 Years) in Urban Slums of Delhi using Anthropometric Measurements"** is hereby approved as a certified study in management carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite for the award of PGDM (Hospital & Health Management) for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

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Dr. Ratika Samtani	

Certificate from Dissertation Advisory Committee

This is to certify that **Maneesh Sharma**, a graduate student of the PGDM (Hospital & Health Management), has worked under our guidance and supervision. She is submitting this dissertation titled **"Assessment of Nutritional Status among Children (0–2 Years) in Urban Slums of Delhi using Anthropometric Measurements"** in partial fulfilment of the requirements for the award of **the PGDM (Hospital & Health Management).**

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

Dr. Ratika Samtani
Associate Professor
IIHMR, New Delhi

CERTIFICATE BY STUDENT

It is hereby certified that the above-mentioned dissertation title **"Assessment of Nutritional Status among Children (0–2 Years) in Urban Slums of Delhi using Anthropometric Measurements"** submitted by **Maneesh Sharma** , Enrolment Number **PG/ 24/ 052** under the guidance of **Dr. Ratika Samtani** for award of **PGDM (Hospital & Health Management)** of the Institute done in the period of **11 march 2026 to 10 june 2026** contains my own efforts and has not been used for awarding any other degree/diploma/fellowship/ associate ship /titles at this Institute or any other institution of higher learning.

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Name of the Organisation in Which Dissertation Has Been Completed: IIHMR

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Strengths: Strong writing and Analytical Skills.

Suggestions for Improvement: Can learn more analytical.

Suggestions for Institute:

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MANEESH
SHARMA

PG/24/052

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ABBREVIATIONS

Abbreviation	Full Form
WHO	World Health Organisation
NFHS	National Family Health Survey
WAZ	Weight-for-Age Z-score
HAZ	Height-for-Age Z-score
WHZ	Weight-for-Height Z-score
MUAC	Mid-Upper Arm Circumference
LBW	Low Birth Weight
SAM	Severe Acute Malnutrition
MAM	Moderate Acute Malnutrition
ASHA	Accredited Social Health Activist
AWC	Anganwadi Centre
AWW	Anganwadi Worker
CBF	Exclusive Breastfeeding
CF	Complementary Feeding
PNC	Postnatal Care

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ABSTRACT:

Background: Malnutrition among children under two years remains a major public health concern in urban slums of India, where poor socioeconomic conditions, inadequate maternal education, and suboptimal feeding practices contribute to high rates of stunting, wasting, and underweight.

Aim: To assess the nutritional status of children aged 0–2 years residing in urban slums of Delhi using anthropometric measurements (weight, length, and MUAC) and to classify malnutrition levels as per WHO Child Growth Standards.

Methodology: A community-based cross-sectional study was conducted among 120 children aged 0–24 months in urban slum areas of Delhi, selected through systematic random sampling. Data on anthropometric measurements, feeding practices, morbidity history, and socio-demographic factors were collected using a pre-tested semi-structured questionnaire.

Results: Of the 120 children studied, 35% were underweight (16.7% underweight, 18.3% severely underweight), 24.2% were stunted, and 26.7% were wasted, including 20% severely wasted (SAM). MUAC screening of 81 eligible children showed 87.7% in the normal range, while 9–10% and 1–2% fell into moderate and severe acute malnutrition zones respectively. Contributing factors included low birth weight (30.8%), limited maternal education (54.2% with limited/no formal education), low household income, inadequate complementary feeding (25.9%), high infection burden (diarrhoea 16.7%, fever 20.2%), and low maternal awareness of SAM (74%).

Conclusion: Malnutrition continues to be a significant public health problem among children under two years in Delhi's urban slums, with prevalence rates exceeding national NFHS-5 averages across all indices. Strengthening growth monitoring, nutrition counselling, and community-level SAM awareness are essential to address this burden.

Chapter 1 Introduction:

Nutritional status is probably the most important indicator of a population's overall public health. Amongst all the groups in the society, children between 0-2 years are the most vulnerable, as these "first 1000 days of life" are the critical periods for physical growth, brain development and determining future health of the child. Undernutrition in this period is mostly irreversible and has long lasting effects on the cognitive function, immune response, academic performance and future productivity.

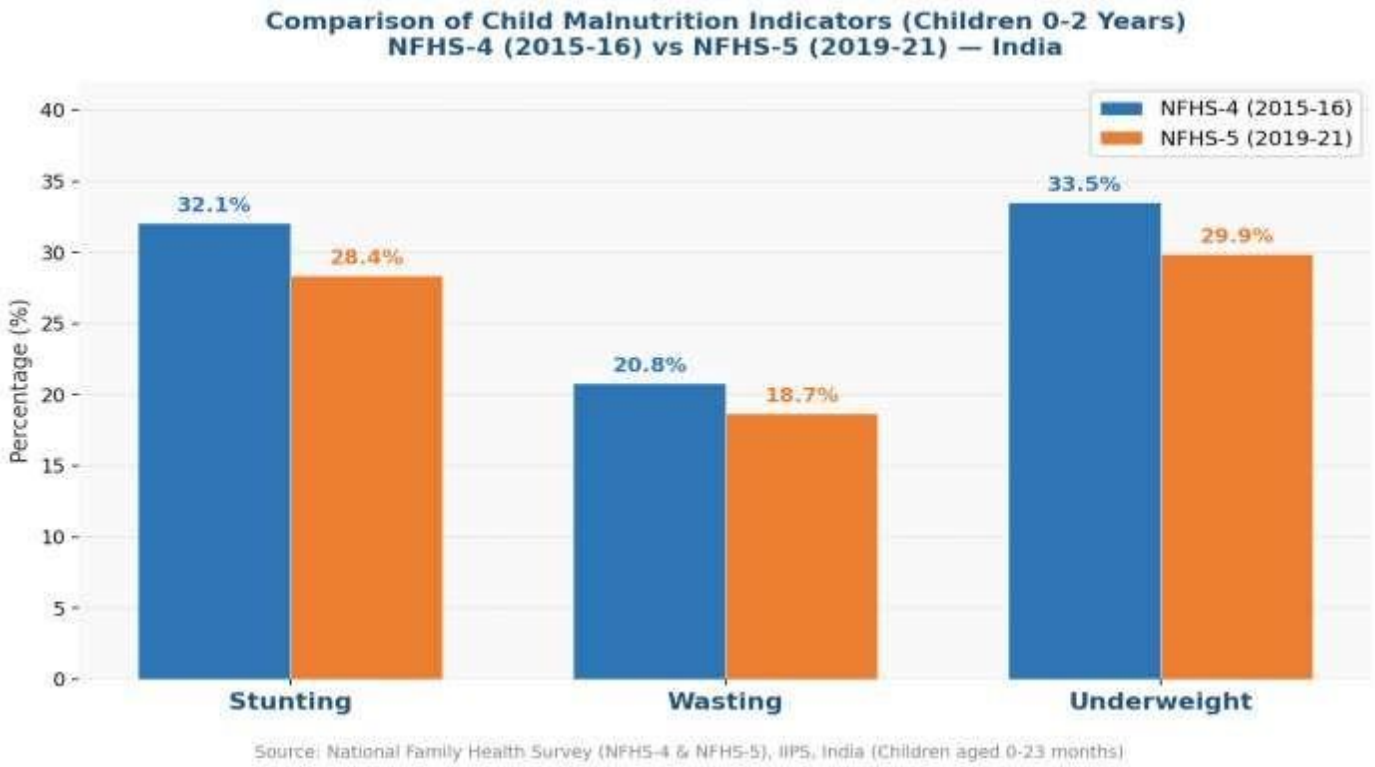
Malnutrition exists in the two forms i.e. Undernutrition (stunting, wasting and underweight) and overnutrition (overweight and obesity) and is still the double burden for the developing countries such as India. NFHS-5 (2019-21) data reveals that in India, about 35.5% of children under five are stunted, 19.3% wasted and 32.1% underweight-an alarming figure which has seen little improvement over decades of nutritional intervention and policy programs. The urban slum scenario is an interesting and yet a paradoxical picture of public health challenge where the children still remain undernourished despite the proximity to an urban center with generally better infrastructure and health services. Poverty, congestion, poor sanitation and drinking water facilities, food insecurity, maternal literacy and health facility access are the several factors responsible for a high state of nutritional risk for the infants and young children residing in the slums.

Children living in urban slums is a silent problem in many Indian cities and even the nation's capital, Delhi is not an exception with substantial number of residents in the unplanned colonies and resettlement areas. The measurements that are globally accepted as simple, non-invasive and cost-effective tools for the nutritional assessment of children are anthropometric measurements. These include: weight, length/height, MUAC and head circumference.These measurements, when interpreted against the WHO Child Growth Standards (2006), allow for the identification of stunting, wasting, underweight, and overweight at both individual and community levels. They are widely used in clinical, field, and epidemiological settings due to their simplicity and reliability.

Nutritional status in children is assessed using anthropometric measurements such as weight, height/length, and MUAC, which are interpreted through Z-scores (Standard Deviation Scores) based on the WHO Child Growth Standards (2006). Z-scores indicate how many standard deviations a child's measurement lies from the reference median. A Weight-for-Age Z-score (WAZ) below -2 SD indicates underweight, Height-for-Age Z-score (HAZ) below -2 SD indicates stunting, and Weight-for-Height Z-score (WHZ) below -2 SD indicates wasting. Z-scores are preferred over other methods as they allow comparison across age and sex groups and are more sensitive in detecting malnutrition at extreme ends of the distribution

Despite the implementation of several national nutrition programs such as the Integrated Child Development Services (ICDS), POSHAN Abhiyaan, and Pradhan Mantri Matru Vandana Yojana (PMMVY), the nutritional status of children residing in urban slums — especially those under two years of age — remains inadequately studied and documented. There exists a significant research gap in systematically assessing this population in urban settings like Delhi, where rapid migration, population density, and socioeconomic disparities further compound nutritional vulnerabilities.

This study was conducted to evaluate the nutritional status of children of 0-2 years living in the slums of urban Delhi with the help of anthropometric indices to produce evidence-based data that may contribute towards public health interventions and improvements in child nutrition programs.


Comparison of Child Malnutrition Indicators (Children 0-2 Years)
NFHS-4 (2015-16) vs NFHS-5 (2019-21) — India
NFHS-4 (2015-16)
NFHS-5 (2019-21)
Percentage (%)
40
35
30
25
20
15
10
5
0
32.1%
28.4%
20.8%
18.7%
33.5%
29.9%
Stunting
Wasting
Underweight
Source: National Family Health Survey (NFHS-4 & NFHS-5), IIPS, India (Children aged 0-23 months)

Chapter 2 Review of Literature

Authors (Year)	Study Location	Salient Features
WHO (2021)	Global	Globally, the under-fives show149 million stunted children, 45 million children wasted, and38.9 million overweight children. The heaviest impact is in South Asia. The WHO recommendation is to use anthropometric measurements as the gold standard for nutritional assessment of young children.
Black et al. (2013)	Global (The Lancet)	Established that undernutrition causes 45% of all under-five deaths. Stunting and wasting during the first 1000 days cause irreversible cognitive and physical damage. Advocated targeted nutritional interventions during 0-2 years as the most cost-effective strategy.
IIPS - NFHS-5 (2019-21)	India (National)	It reported the prevalence of stunting at 35.5%, wasting at 19.3% and underweight at 32.1% in Indian children under the age of five. Children in urban slums were comparable in their nutritional indicators as those in rural areas suggesting need of urban poor focused programs.
Ghosh and Shah (2004)	Mumbai, India (Urban Slums)	Undernourished 45.6% and stunted 40.3% among slum children. Although urban based, the nutritional status of the slum children is on par with the rural status. Maternal low level of education, large family and the inadequate complimentary feeding were determining factors..
Meshram et al. (2012)	Multiple Indian Cities (NNMB)	WAZ and HAZ scores were notably lower for children from urban slums compared to WHO norms. Chronic malnutrition was present to a greater extent than acute malnutrition, reflecting prolonged food insecurity and inadequate feeding practices..
Sinha et al. (2018)	Kolkata, India (Urban Slums)	Identified stunting 46.7%, underweight 39.2% and wasting 22.4% among children 6-24 months. The leading factors were non-exclusive breastfeeding and

Authors (Year)	Study Location	Salient Features
		late complementary feeding. Counseling on IYCF for urban slums recommended.
Agarwal et al. (2017)	Delhi, India (Urban Slums)	Of children under two years, 40% are reported as being underweight, 37% as being stunted and 18% as wasted. Significant risk factors reported were low income, low maternal literacy, short breastfeeding period and inadequate complimentary feeding.
Victora et al. (2016)	Multi-country (The Lancet)	Showed that poor breastfeeding was a significant predictor of stunting and wasting at 24 months of age. Children who were not breastfed had significantly lower HAZ and WAZ score compared with exclusively breast fed children.
Singh et al. (2009)	East Delhi, India (Resettlement Colonies)	Children under two were reportedly stunted at 44.2% and underweight at 41.8%. Risk of malnutrition was high for households without latrine, with a monthly income less than Rs. 3000 and uneducated mother.
Vaid et al. (2020)	Delhi, India (JJ Colonies)	In this study growth retardation was seen as being highest among 6-18 months and is associated with introduction of complementary feeds. The Weight-for-Length Z scores were the lowest between 6-18 months of life. Deficiency in quality and timely introduction of complementary feeds caused acute malnutrition.
Ramakrishnan et al. (2012)	Global (Multi-country)	Maternal nutrition, effect on child growth was reviewed. Maternal undernutrition which was indicated by inadequate gestational weight gain, anemia and short stature have significant correlation with low birth weight and stunting at the age of children below 2 years.
Checkley et al. (2008)	Peru, South America	Demonstrated that repeated episodes of diarrheal disease in early childhood in poor sanitation environments led to significant growth faltering. Children with frequent diarrhea had 1.5 cm lower height by age two compared to unaffected children.
Kumar et al. (2015)	Uttar Pradesh, India	Conducted a community-based study among children under two years in low-income urban settlements.

Authors (Year)	Study Location	Salient Features
		Reported stunting 48.3% and underweight 43.7%. Found that birth order above three and lack of antenatal care visits were independent predictors of child malnutrition.
Kapil and Bhavna (2002)	Delhi, India	Reported that despite being the national capital with better health infrastructure, Delhi's slum children suffered from high rates of protein-energy malnutrition and micronutrient deficiencies, particularly iron-deficiency anemia and Vitamin A deficiency among children under two years.
Pradhan et al. (2014)	Odisha, India (Urban Slums)	Assessed nutritional status of 420 children aged 0-24 months using WHO growth standards. Found 52% stunting, 44% underweight, and 28% wasting. Identified that children of daily wage laborers and those with birth interval less than two years were at highest nutritional risk.
Bhandari et al. (2002)	Delhi and Haryana, India	Validated the use of anthropometric measurements - particularly MUAC and weight-for-length - for identifying acute malnutrition among Indian infants. Concluded that these measures are both sensitive and specific for field-based nutritional assessments in resource-limited settings.
Waterlow et al. (1977)	Global (WHO Reference)	Proposed standardized classification of malnutrition using anthropometric indices, laying the foundation for current WHO growth standards. Their classification of stunting based on Height-for-Age and wasting based on Weight-for-Height continues to be used globally.
WHO Multicentre Growth Reference Study Group (2006)	Six Countries (Global)	Developed internationally applicable growth standards based on children raised under optimal conditions across Brazil, Ghana, India, Norway, Oman, and USA. These standards are universally recommended for assessing nutritional status in children from birth to five years.

Authors (Year)	Study Location	Salient Features
Lal et al. (2020)	Rural India (Community-based)	Conducted a cross-sectional study and found stunting prevalence of 42.3% and underweight of 38.6% among children below two years. Maternal illiteracy and poor dietary diversity were the strongest predictors. Recommended community nutrition education as a priority intervention.
UNICEF Global Nutrition Report (2022)	Global	Highlighted that progress in reducing child malnutrition has been uneven across regions. South Asia and Sub-Saharan Africa continue to have the highest burden. Emphasized the need for country-specific, community-level interventions targeting children in the first two years of life.

Research Aim and Objective:

Aim: to assess the nutritional status of children aged 0 to 2 years living in urban slums of Delhi by using anthropometric measurements such as weight, height, and MUAC, and to identify the level of malnutrition among them using the WHO growth standards.

Objectives:

1. To measure the weight and length of children aged 0–24 months.

2. To assess the nutritional status using anthropometric indices (weight-for-age, length-for-age, and weight-for-length) based on World Health Organization standards.

3 To identify factors associated with malnutrition, such as infant feeding practices, maternal education, and socio-economic status.

4 To classify the nutritional status of the study children according to WHO Child Growth Standards

Chapter 3 Methodology

3.1 Study Design

A community-based cross-sectional study was carried out to assess the nutritional status of children aged 0–2 years residing in urban slums of Delhi. A cross-sectional design was chosen as it allows the

collection of data at a single point in time from a defined population, making it suitable for determining the prevalence of malnutrition and its associated factors.

3.2 Study Area

This study was carried out in some of the slum areas of Delhi (urban). The slum areas were selected on the basis of population density, adverse socioeconomic status and poor healthcare and nutritional services availability.

3.3 Study Population

The study population included all the children 0-2 years of age (0-24 months) residing in the urban slums of Delhi and their respective mothers/ caregivers.

3.4 Sample Size

The sample size will be calculated using the formula:

Where:

Z = 1.96 (95% confidence level)

P = 0.5 (assumed prevalence)

Q = 1 – p = 0.5

D = 0.1 (10% precision)

Calculated sample size = 96

After adding non-response, final sample size = 120 children

3.5 Sampling Method

Systematic random sampling method was used for the selection of study participants. The households with children aged 0–2 years were listed from each selected slum area with the help of local ASHA workers and Anganwadi records. Every alternate eligible household was then selected systematically until the required sample size of 120 children was achieved.

3.6 Inclusion Criteria

Children aged 0–24 months residing in the selected urban slum areas of Delhi

Children whose parents or guardians gave written informed consent to participate in the study

Children who were permanent residents of the study area for at least 6 months

3.7 Exclusion Criteria

Children with known chronic illness, congenital abnormalities, or physical disabilities that could affect anthropometric measurements

Children whose parents or guardians refused to give consent

Children who were temporarily residing in the study area

3.8 Study Instrument

A) Pre-tested semi-structured questionnaire

B) Anthropometric tools

- Digital weighing scale (for weight)
- Infantometer (for length)

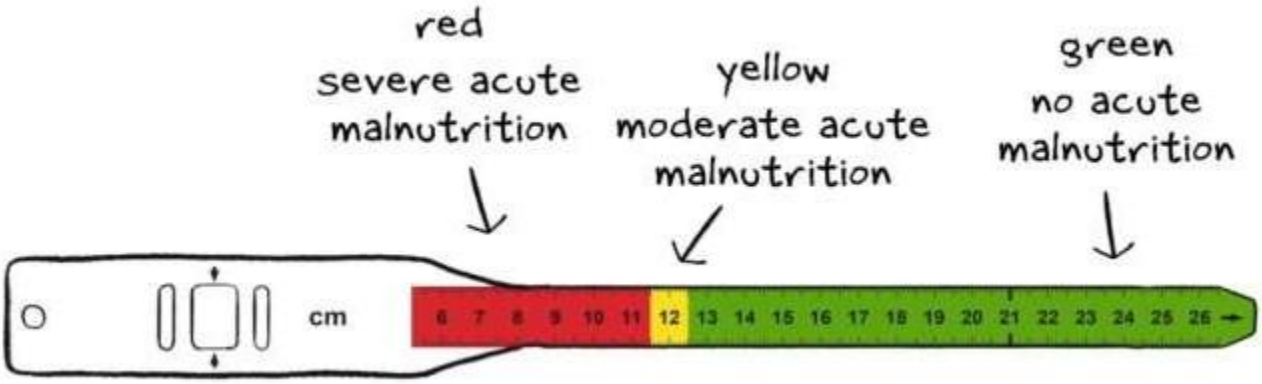
C) WHO Growth Standards

Used for assessing:

- Weight-for-age
- Length-for-age
- Weight-for-length

D) MUAC Tape (Optional)

For children above 6 months (screening of acute malnutrition)



3.9 Time duration:

2 months

Chapter - 4 Result

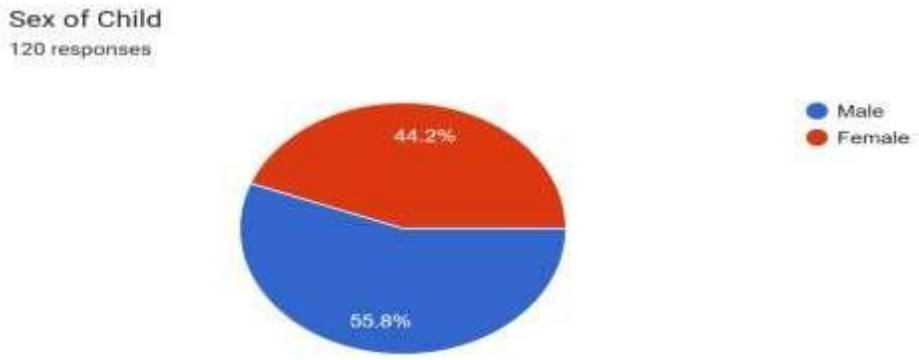


Figure 4.1 Interpretation-Overall, there were 120 children in the study with 55.8% being males and 44.2% being females. From these numbers it can be seen that the males were in the majority of the children that took part in the study and the females were in the minority of children. Overall there was quite a balanced spread of sexes with more males in the sample than females.

Age of Child (in months):

Age OF child (In months)	No.of .children
0-6 Months	36
7-24 Months	84
Total	120

Table 4.1 Interpretation- Out of 120 children enrolled in the study, 36 (30.0%) belonged to the age group of 0-6 months, whereas 84 (70.0%) belonged to the age group of 7-24 months. Most of the children belonged to the age group of 7-24 months.

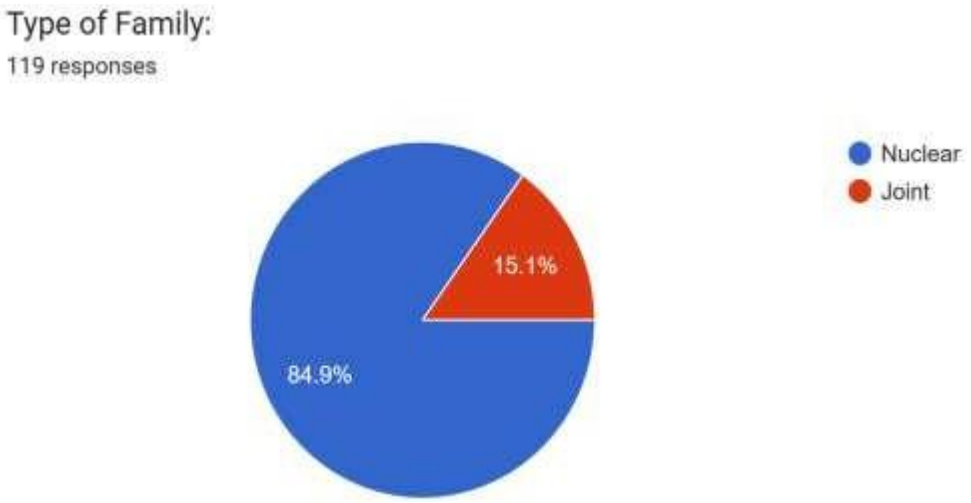


Figure 4.2 Type of family (interpretation) - There were 84.9% and 15.1% of children belonging to nuclear and joint families respectively. The results reflect that most of the children were born in a nuclear family whereas only a fraction of them in a joint family.

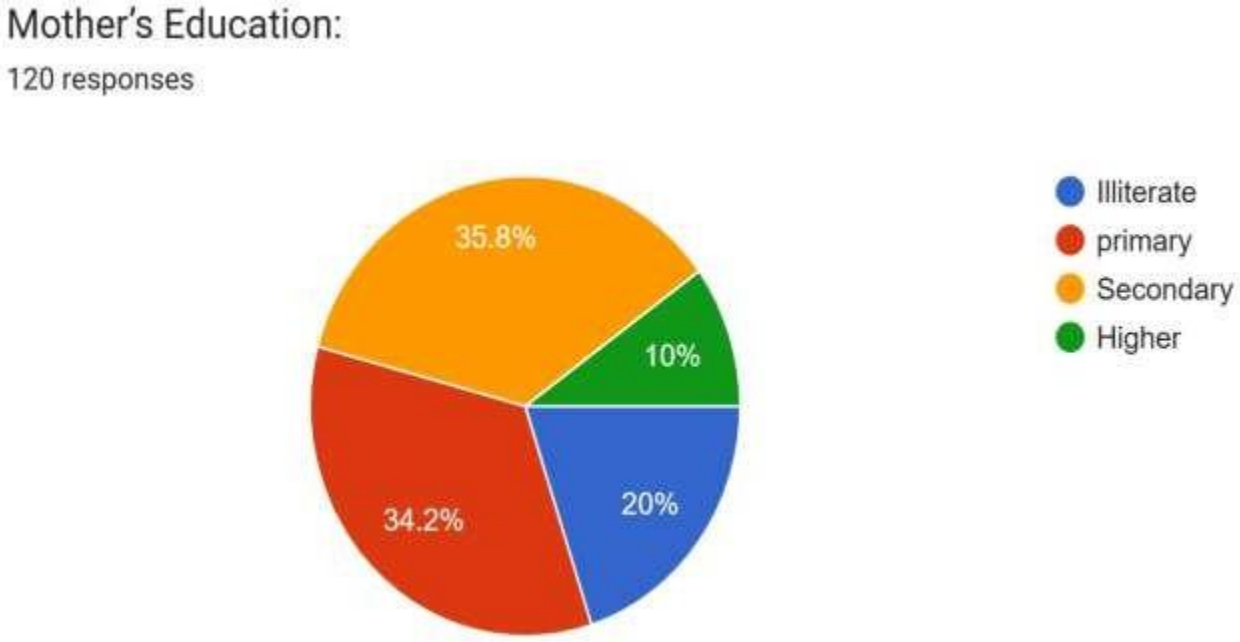


Figure 4.3 Interpretation mother's education- Majority of mothers were educated to secondary level (35.8%), whereas only 34.2% had primary level of education and 20% of the mothers were illiterate and only 10% had higher level education. From this it is evident that more than 50% of mothers in this population had inadequate level of education, which itself is an area of major concern as inadequate level of education is one of the strong risk factors for malnutrition among children as well as for poor infant feeding practices and under-utilization of healthcare services.

Interpretation of mother occupation - Information about the occupational status of mothers shows that (77.5 %) were house wives, while (22.5%) were working. Therefore, it can be concluded that most of the children participating in the study belong to a family whose mother's concern is home and children.

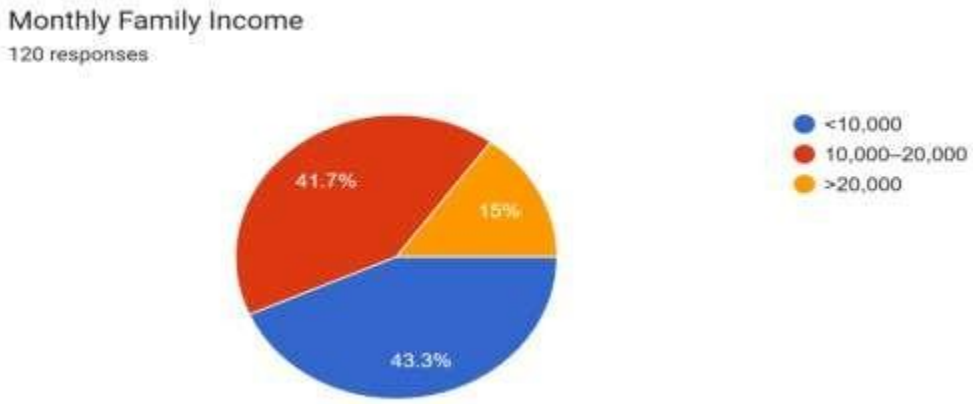


Figure 4.4Interpretation of monthly family income-Majority of families (43.3%) have less than 10,000 per month income; 41.7% of families have an income between 10,000-20,000 per month; while 15% of families have more than 20,000 per month. It shows that overwhelmingly, 85% of families in the studied population were below the poverty line or were near to it, which obviously influences on food buying power, medical care services and better life style-main factors that determined nutritional status of young children.

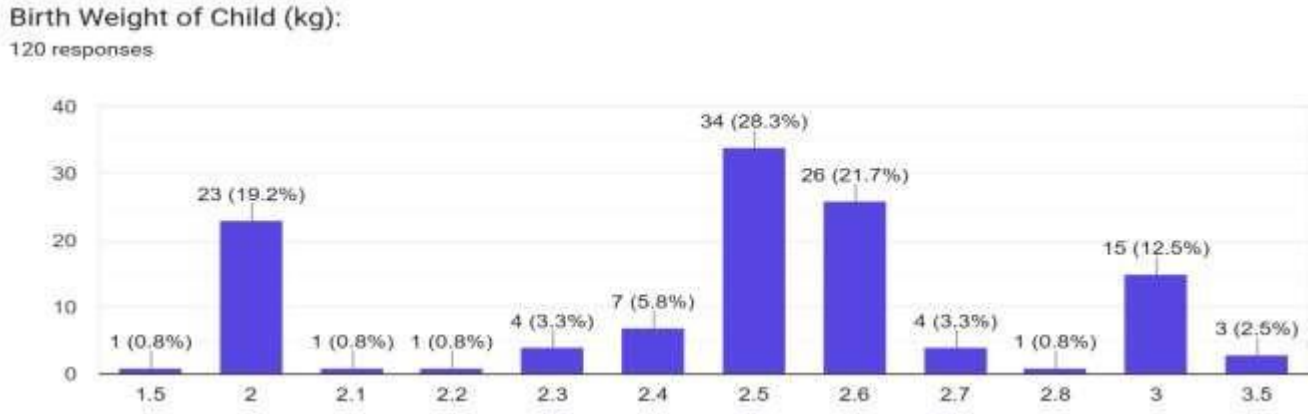


Figure 4.5Interpretation - This bar chart shows the frequency distribution of birth weight for the 120 children in this study. Most children had a birth weight of 2.5 kg, with 34 children (28.3%). Twenty-six children had a birth weight of 2.6 kg (21.7%) and 23 children weighed 2.0 kg at birth (19.2%).A total of 37 children (30.8%) had a birth weight of less than 2.5 kg, which is classified as Low Birth Weight (LBW) according to WHO criteria. This is a matter of significant concern as low birth weight is strongly associated with higher risk of stunting, wasting, underweight, and impaired cognitive development in early childhood. Only 15 children (12.5%) had a birth weight of 3 kg and 3 children (2.5%) had 3.5 kg, indicating that a relatively small proportion of children were born with adequate to healthy birth weight. These findings suggest that poor maternal nutrition, inadequate antenatal care, and low socioeconomic status prevalent in urban slum areas of Delhi may have contributed to the high prevalence of low birth weight among the study children.

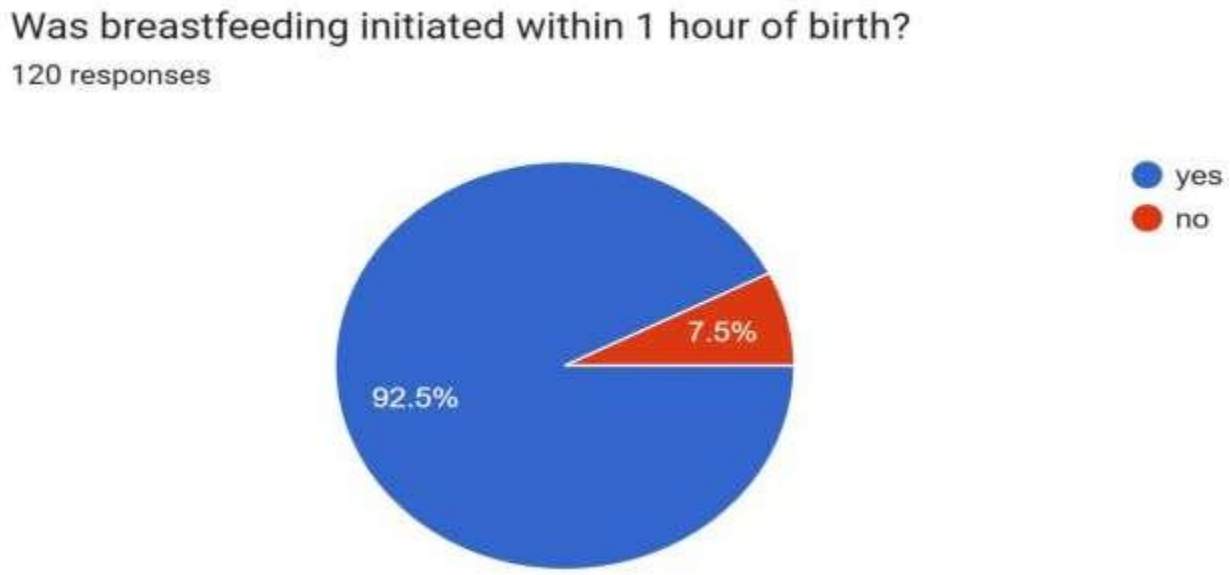


Figure 4.6Interpretation - A large majority of 111 mothers (92.5%) initiated breastfeeding within one hour of birth, while only 9 mothers (7.5%) did not do so. This is a very encouraging finding as early initiation of breastfeeding within the first hour of birth is strongly recommended by WHO and UNICEF as it ensures that the newborn receives colostrum — the first milk which is rich in antibodies, nutrients, and immunity-boosting properties.

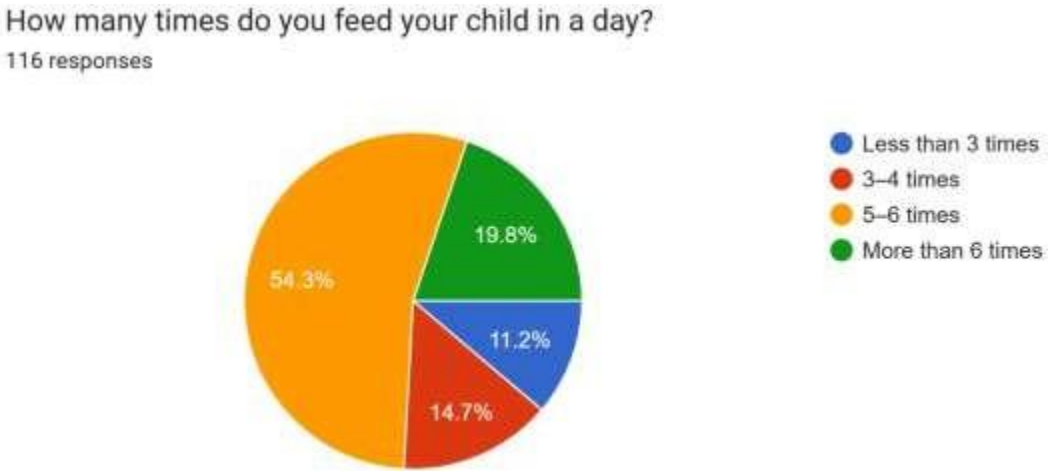


Figure 4.7 Interpretation- 95% of children were currently being breastfed while only 5% were not receiving breast milk at the time of data collection, indicating that breastfeeding continuation was fairly well practised among mothers residing in the urban slum areas of Delhi.

The majority of mothers 54.3% fed their child 5–6 times a day, followed by 19.8% who fed their child more than 6 times a day, while 14.7% fed their child only 3–4 times, and 11.2% fed their child less than 3 times a day. These findings indicate that although a good proportion of mothers maintained an adequate feeding frequency, nearly 25.9% of children were being fed less than the recommended minimum meal frequency as per WHO guidelines, which suggests insufficient dietary intake in a significant number of children. Inadequate feeding frequency is a well-known risk factor for poor growth and malnutrition in children under two years of age, and the mothers practising low feeding frequency in this study population may require targeted nutrition counselling to improve child feeding behaviours.

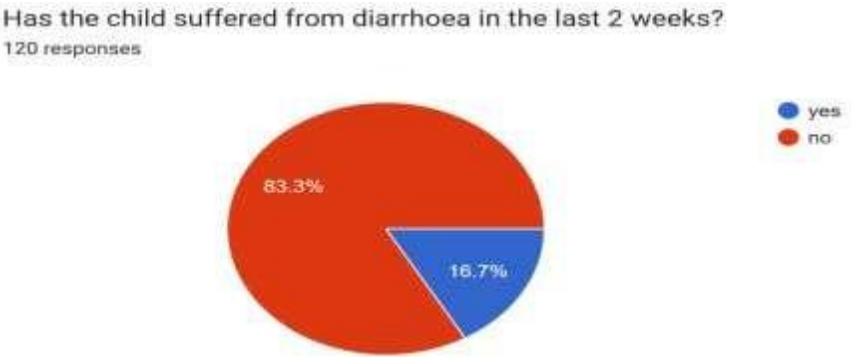


Figure 4.8Interpretation-83.3% of children did not have diarrhoea in the past two weeks. However 16.7% (approximately 20) children did have diarrhoea in the past 2 weeks. While most children did not have diarrhoea, it was concerning to note that the condition affects almost one in six children, due to a variety of causes, including repeated attacks in young children lead to loss of nutrients, poor nutrient absorption and thus a slow growth.

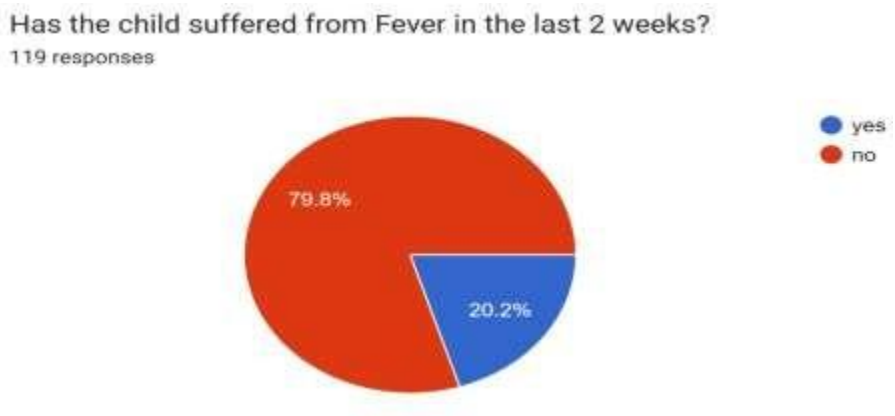


Figure 4.9Interpretation-79.8% of children were without fever during the last two weeks while 20.2% of children (approx 24) had fever during this period. The existence of one fifth of children having fever just in the last 2 weeks reveals the burden of infection in the context of slum environment which is usually crowded, have poor ventilation and poor sanitary conditions favorable for epidemic infectious diseases.

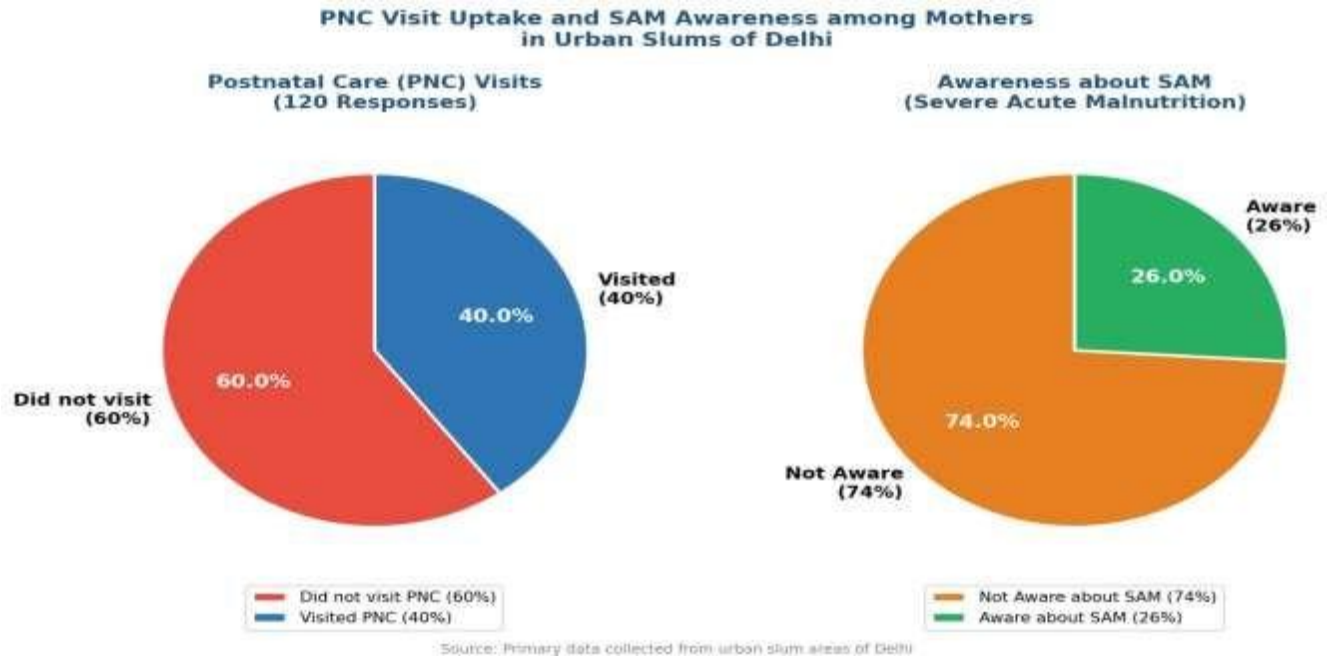


Figure 4.10 -60% of mothers have not made any PNC visit to a healthcare facility after delivery, and only 40% availed the PNC services after delivery. This is worrisome because postnatal visits are crucial for the follow up of the mother and new born health status and nutritional status of mother and new born after delivery.

74% of mothers did not know about Severe Acute Malnutrition (SAM), only 26% know about it. This implies that in urban slums of Delhi, there is a dire nutrition literacy of mother. SAM is an immediate life threatening type of malnutrition; it is defined by very low weight-for-height, visible severe wasting or nutritional edema, and necessitates an immediate referral to medical care provider. Because of unawareness of majority of mothers, children with SAM will not receive immediate attention and timely referral.

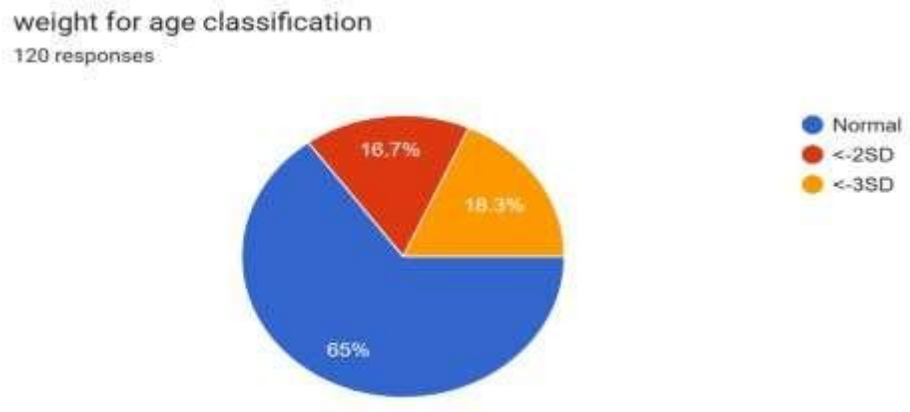


Figure 4.11 Interpretation: The data reveals that 65% of children (78 children) had normal weight-for-age (≥ -2 SD), indicating adequate nutritional status as per WHO Child Growth Standards (2006). However, a significant proportion of children were found to be undernourished — 16.7% of children (20 children) were underweight (WAZ < -2 SD), while 18.3% of children (22 children) were severely underweight (WAZ < -3 SD).

These findings indicate that a total of 35% of children (42 out of 120) in the study population were suffering from some degree of underweight, which is a matter of serious public health concern. The prevalence of severe underweight (18.3%) is particularly alarming as it reflects deep-rooted and long-standing nutritional deprivation among young children in urban slum settings of Delhi.

The high burden of underweight observed in this study is consistent with findings reported by NFHS-5 (2019–21), which recorded 32.1% underweight prevalence among Indian children under five years, and is even higher than the national average — suggesting that urban slum children of Delhi face a disproportionately greater nutritional risk compared to the general population.

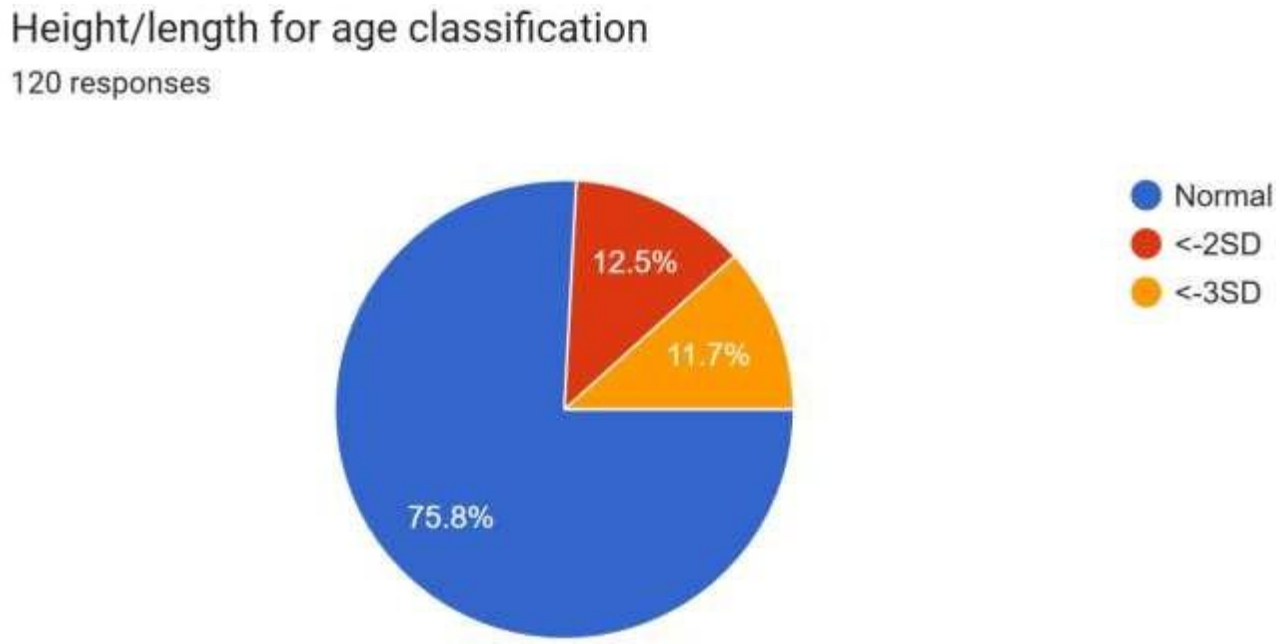


Figure 4.12 Interpretation- Out of 120 children assessed, 91 (75.8%) had normal height/length-for-age, 15 (12.5%) were stunted (< -2 SD), and 14 (11.7%) were severely stunted (< -3 SD). The findings indicate that although the majority of children exhibited normal linear growth, nearly one-fourth (24.2%) suffered from stunting, highlighting the presence of chronic undernutrition among children in the study area.

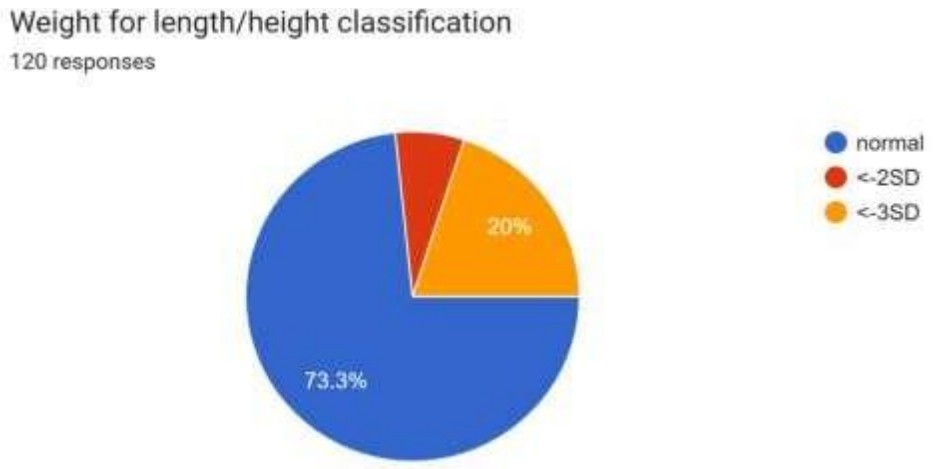


Figure 4.13Interpretation-The data reveals that 73.3% of children (88 children) had normal weight-for-length/height (WHZ ≥ -2 SD), indicating adequate current nutritional status as per WHO Child Growth Standards (2006). However, a significant proportion of children were found to be wasted — 6.7% of children (8 children) were wasted (WHZ < -2 SD), while 20% of children (24 children) were severely wasted (WHZ < -3 SD).

These findings indicate that a total of 26.7% of children (32 out of 120) in the study population were suffering from wasting in some form. The severely high proportion of severe wasting (20%) is extremely alarming as severe wasting or Severe Acute Malnutrition (SAM) is a life-threatening condition that requires immediate medical intervention.

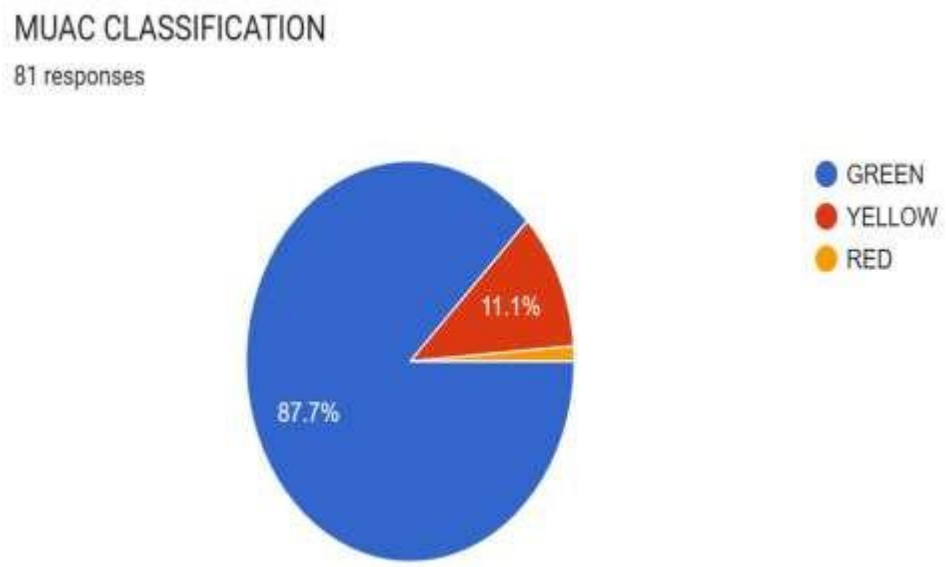


Figure 4.14 Interpretation-The pie chart presents the Mid-Upper Arm Circumference (MUAC) classification of 81 children aged 6 months and above who were assessed in the present study. MUAC is a quick and reliable field-based tool used to identify acute malnutrition in young children, classified into three color-coded zones — Green (normal), Yellow (moderate acute malnutrition), and Red (severe acute malnutrition).

The data reveals that the large majority of children 87.7% (71 children) fell in the GREEN zone (MUAC ≥ 12.5 cm), indicating normal nutritional status. approximately 9–10% of children fell in the YELLOW zone (MUAC 11.5–12.4 cm), indicating Moderate Acute Malnutrition (MAM), while 1–2% of children fell in the RED zone (MUAC < 11.5 cm), indicating Severe Acute Malnutrition (SAM) — a life-threatening condition requiring immediate medical referral and treatment.

Chapter 5 DISCUSSION:

1. Socioeconomic and Demographic Findings

The present study found that a large proportion of families (43.3%) earned less than ₹10,000 per month, and more than half of the mothers (54.2%) had limited or no formal education. These findings are in agreement with Agarwal et al. (2017), who reported that low household income and poor maternal literacy were the most significant risk factors for malnutrition among slum children in Delhi. Similarly, Singh et al. (2009) observed in their study conducted in resettlement colonies of East Delhi that households with a monthly income below ₹3,000 and uneducated mothers had significantly higher rates of child malnutrition, which is consistent with the socioeconomic profile observed in the present study.

2. Low Birth Weight

The present study found that 30.8% of children had low birth weight (less than 2.5 kg), which is a strong early predictor of subsequent malnutrition and growth faltering. This finding is supported by Ramakrishnan et al. (2012), who established through a global multi-country review that low gestational weight gain, maternal anaemia, and poor maternal nutritional status were strongly associated with low birth weight and subsequent stunting in children under two years of age. The high prevalence of low birth weight observed in this study reflects the poor maternal health and nutritional status of women residing in urban slum areas of Delhi.

3. Breastfeeding and Feeding Practices

An encouraging finding in the current study was that 92.5% of mothers breast fed within the first hour of birth and 95% of children was currently breastfeeding. This is encouraging since this has been an important recommendation from WHO (2021) and UNICEF Global Nutrition Report (2022), which recommends initiation of breastfeeding within the first hour of birth as crucial for child survival and nutrition. Nevertheless, 25.9% of children was being fed at frequencies below minimum, which shows the poor complementary feeding practice in this population. Similar results has been demonstrated in a study in India in an urban slum of Kolkata by Sinha et al. (2018) who identified suboptimal feeding of delayed and inadequate complementary feeding as an important risk factor for stunting and underweight children aged 6-24 months. Similarly Victora et al. (2016) have showed strong relationship between feeding practice and nutritional status by indicating that feeding practice was strongly associated with HAZ and WAZ scores at 24 months of age and that the nutritional deficiency identified in the present study.

4. Infection Burden

The current study showed that 16.7% and 20.2% of children had experienced diarrhea and fever respectively in previous two weeks indicating heavy burden of infection in the population being studied. This observation correlates with the work of Checkley et al (2008) where frequent occurrences of diarrheal illness in young childhood, in conditions of poor sanitation resulted in substantial growth faltering and those affected children were substantially shorter (by the age of two years) compared to those not suffering from such disease. Overcrowded living conditions and insanitary environments like slum areas of Delhi support easy transmission of infections and in turn deteriorates nutritional status of children because of lack of appetite and reduced absorption of nutrients and increase in metabolic requirements.

5. Underweight

In the present study, overall underweight children were 35% among which 16.7% underweight children (WAZ < -2 SD) and 18.3% were severely underweight children (WAZ< -3 SD). Similar high prevalence was found in study by Agarwal et al. (2017) who observed approximately 40% underweight children under 2 years in slum areas of Delhi. Ghosh and Shah (2004) observed 45.6% underweight prevalence in urban slums of Mumbai city which show that underweight is an ongoing nutritional problem in urban slum areas of the country. In India national average for underweight reported as per NFHS-5 (2019-21) was 32.1% for all children below 5 years which clearly shows the double burden of nutrition in under 2 years children in Delhi slums where prevalence was found to be 35%.

6. Stunting

The present study found that 24.2% of children were stunted, 12.5% stunted (HAZ < -2 SD) and 11.7% severely stunted (HAZ < -3 SD). This is lower than figures reported by Singh et al. (2009), who found 44.2% stunting in resettlement colonies of East Delhi, and Kumar et al. (2015), who reported 48.3% stunting in low-income urban settlements of Uttar Pradesh. However, it is consistent with findings of Vaid et al. (2020), who observed that growth faltering in Delhi's JJ colonies was most pronounced during the 6–18 month age period, coinciding with the complementary feeding transition — a pattern also reflected in the age distribution of the present study. The presence of stunting at such an early age indicates chronic nutritional deprivation that, if left unaddressed, will have irreversible consequences on the child's cognitive and physical development as highlighted by Black et al. (2013).

7. Wasting

Of grave concern in the current study was the high degree of wasting found-26.7% children were wasted, with 20% wasted Children having severe wasting (WHZ < -3 SD). The wasting prevalent in the current study (26.7%) is significantly higher compared to National wasting prevalence of 19.3% reported by NFHS-5 (2019-21), and much higher compared to WHZscores reported by Sinha et al., (2018) in urban slum of Kolkata (22.4% wasting).Similarly Meshram et al., (2012) reported significantly poor WHZ score in urban slum children in compare to WHO standard and highlighted that the problem of acute malnutrition is still not solved in the Indian urban slum settings. In the current study we see much larger percentage of children with severe wasting, and as it shows that 74% mothers had no awareness of SAM; it is most likely that majority of severely wasted children could be neither identified nor referred to for treatment.

8. MUAC Classification

The MUAC screening for 81 children showed that 87.7% children fall in the GREEN zone (normal), 9-10% in YELLOW zone (MAM) and 1-2% in RED zone (SAM). These results corroborate with the study by Bhandari et al. (2002) who found MUAC to be a sensitive and specific indicator for detection of acute malnutrition in infants in rural India in a field setting, and that it should be regularly employed for community based screening programs. In identifying the children in YELLOW and RED zone further underlines the requirement for regular screening using MUAC in Anganwadi centres and Primary health centres in an urban slum area in Delhi.

Limitations

- Only 120 children were studied, so these results might not be typical of the population of the urban slum dwellers of Delhi.
- The feeding practices and morbidity history of the children were obtained by the mothers during an interview, thus recalling history is subject to a recall bias.
- Socio-economic Data: The household income was reported by the mothers themselves; the same may not always represent the actual status of the household.
- MUAC: The MUAC value for 81 children (only those aged 6 months and above) was recorded and for the remaining 39 children the MUAC value could not be recorded.

Chapter – 7 Conclusion

In the current study it has been concluded that malnutrition is still a common and major public health problem in 0-2 year children living in urban slums of Delhi. It was observed that a significantly high proportion of children were underweight (35%), stunted (24.2%) and wasted (26.7%), the most startling of which is 20% being severely wasted and all above national values based on NFHS-5(2019-21). It is a combination of poor low birth weight rate (30.8%), poor mother's education, low family income, infrequent feeding, high illness burden, low utilization of post natal care and 74% of mothers unaware of SAM which is contributing to the vast burden of malnutrition in these underprivileged children. Thus even with national nutrition programs, urban slum children of Delhi continue to remain deprived and need special attention from government to combat the challenge of malnutrition.

Chapter 8 Recommendations

1. **Strengthening Growth Monitoring**:

All children in the 0-2 years should have their weights, heights and MUAC measured each month at each Anganwadi center so that the children with faltering in growth could be identified early and referred for treatment.

2. Nutrition Counseling for Mothers:

Nutrition education sessions for mothers of young children need to be conducted at the community level on a regular basis, and cover issues like appropriate breastfeeding practices, appropriate timely introduction of complementary feeding, importance of diverse diets, and promotion of hygiene.

3. **SAM Awareness and Screening:**

Since the lack of knowledge of Severe Acute Malnutrition among the mothers was in 74% of the women, there should be active awareness campaigns on SAM identification and treatment at the grassroot level using ASHA workers, Anganwadi workers and PHCs at all the slum areas in Delhi.

4. **Postnatal Care Promotion:**

Because 60% of the mothers did not utilize postnatal care service. We need to reinforce PNC follow-up, utilizing ASHA worker visits at homes and during the antenatal care visits, a counseling could be done with the mother so that she can use the PNC service after delivery.

5. **Infection Prevention:**

To tackle the excessive incidence of diarrhea and fever, leading to the deteriorating child nutritional status, interventions to ensure safe drinking water, sanitation and promotion of hand-washing and childhood immunization, should be reinforced in urban slum areas.

6. **Socioeconomic Support:**

Effective delivery and monitoring of programs offering food supplements, conditional cash transfers, and livelihood support to the poor families dwelling in the slums of the cities is required to attack the root causes of malnutrition.

7. **Strengthening ICDS and POSHAN Abhiyaan:**

Existing Anganwadi centers under ICDS and POSHAN Abhiyaan should be supported with sufficient workforce, materials, and supervision so that no slum child is denied their right to nutritional services in urban areas.

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https://www.who.int/news-room/fact-sheets/detail/malnutrition

https://www.who.int/tools/child-growth-standards

https://poshanabhiyaan.gov.in/

https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(13)60937-X/abstract

https://onlinelibrary.wiley.com/doi/10.1111/j.1740-8709.2011.00349.x

Consent Form

You are invited to take part in a research study entitled:"Assesement of Nutritional Status among children 0-24 months old, in the slums of urban Delhi, with use of anthropometric measurements". The study aims to asses nutritional status among children and factors related to their nutrition. Your participation is entirely voluntary. Please read the following before you consent to participate in the study:

You have been explained in a language which you understand regarding the objectives of the study.

You can refuse to participate or withdraw from the study at any time without any penalty. All information will be kept confidential and used for research purpose only. No details that identify you will be revealed in any publication. The procedure is expected to take about 15-20 minutes, the measurements involving your childs weight and length.

Questionnaire:

Section A: Consent

Are you willing to participate in this study?

☐ Yes

☐ No

Section B: Identification Details

Name of Child: _____

Age of Child (in months): _____

Name of respondent (mother/guardian): _____

Sex of Child:

☐ Male

☐ Female

Section C: Socio-Demographic Details

Type of Family:

☐ Nuclear

☐ Joint

Mother's Education:

☐ Illiterate

☐ Primary

☐ Secondary

☐ Higher

Mother's Occupation:

☐ Homemaker

☐ Working

Monthly Family Income:

☐ <10,000

☐ 10,000–20,000

☐ >20,000

Section D: Birth Details

Birth Weight of Child (kg): _____

☐ Known

☐ Not known

Section E: Feeding History

Was breastfeeding initiated within 1 hour of birth?

Yes / No

Is the child currently breastfed?

Yes / No

How many times do you feed your child in a day?

Less than 3 times

3–4 times

5–6 times

More than 6 times

Section F: Health & Morbidity

Has the child suffered from diarrhoea in the last 2 weeks?

Yes / No

Has the child had fever or infection in last 2 weeks?

Yes/ No

Section F: Anthropometric Measurements

Weight of child (kg): _____

Height/length of child (cm): _____

Mid Upper Arm Circumference (MUAC) (cm) (if applicable): _____

Section F: Classification (for researcher use)

Height-for-age: Normal / < -2 SD / < -3 SD

Weight-for-height: Normal / < -2 SD / < -3 SD

Have you attended a postnatal care check up after delivery? Yes/no

Have you ever heard about severe acute malnutrion [SAM]? YES/NO

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