

# Magnitude of malnutrition among underfive children in urban slums of commercial capital of India and its multifactorial causation: A community-based study

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## ABSTRACT

**Context:** Malnutrition in children is common globally and may result in both short- and long-term irreversible negative health outcomes. It is not a simple disease with single causative factor but it is a disease with multifactorial causation. **Aims:** 1) To estimate prevalence of malnutrition in underfive children using “Z” score. 2) To evaluate the role of epidemiological and maternal factors on the nutritional status of children. **Settings and Design:** Community-based cross-sectional study. **Methods and Materials:** Randomly 10 slums were selected and under five-year-old children and their mothers from urban slums were examined and interviewed. **Statistical Analysis:** Data was analyzed with SPSS ver 20 and appropriate tests were applied. **Results:** Four-hundred children were examined. According to Z score classification, 39.8%, 36.5%, and 24.8% of children are underweight, stunted, and wasted, respectively. Family size ( $P = 0.02$ ,  $\chi^2 = 7.7$ ), initiation of breastfeeding ( $P = 0.009$ ,  $\chi^2 = 6.8$ ), maternal education ( $P = 0.001$ ,  $\chi^2 = 13.9$ ), underweight mothers ( $P = 0.05$ ,  $\chi^2 = 4.8$ ), and maternal dietary intake ( $P = 0.03$ ,  $\chi^2 = 6.5$ ) are significantly associated with underweight children. Similarly, stunted children show strong association with increasing age of child ( $P = 0.001$ ,  $\chi^2 = 18.1$ ), birth weight ( $P = 0.006$ ,  $\chi^2 = 7.6$ ), and not seeking medical opinion ( $P = 0.03$ ,  $\chi^2 = 7.0$ ). Primary immunization ( $P = 0.05$ ,  $\chi^2 = 3.5$ ), maternal education ( $P = 0.002$ ,  $\chi^2 = 12.4$ ), employed mothers ( $P = 0.02$ ,  $\chi^2 = 4.9$ ), and underweight mothers ( $P = 0.05$ ,  $\chi^2 = 5.3$ ) are associated with wasting in children. **Conclusions:** This study reveals very high prevalence of malnutrition status among underfive children of urban slums of commercial capital of India. Various maternal and epidemiological factors affect child nutritional status.

**Keywords:** Malnutrition, underfive children, urban slums

## Introduction

Malnutrition is more prevalent in developing countries. Malnutrition was the predominant risk factor for death in underfive children accounting for 68.2% in India in 2017.<sup>[1]</sup> The commercial capital of the country, Mumbai, has much appeal to anyone in search of work and better career prospects. Many rural-urban migrant workers cannot afford housing in the cities

and eventually settle down in slums. Lack of basic facilities makes slum dwellers vulnerable to infections which adversely affect their nutritional status.<sup>[2]</sup> It is not a single problem with single solution. Multifactorial causation needs multipronged strategies to alleviate the problem of malnutrition.<sup>[3]</sup>

Inadequate intake of food along with various factors—socio-demographic, environmental, nutritional, and most important maternal factors contribute to child malnutrition. There is enough scientific evidence indicating the importance of the first 1000 days of a child's life.<sup>[4]</sup>

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This special group of underfive children constituting 15% of total population is in their growing and developing period but suffer high rates of morbidity and mortality. Malnutrition affects in later life. Health of underfive children and family-health are interrelated.<sup>[5]</sup> In view of this context, the present study is intended to estimate the magnitude of the problem of malnutrition and the factors consistent with the same in underfive children in urban slums of Mumbai. The current study will be helpful to design the strategies to alleviate the problem of malnutrition.

## Subjects and Methods

### Study design and setting

The present study is a community-based cross-sectional study aimed at primarily assessing malnutrition status among underfive children in urban slums and its association with a variety of maternal, sociodemographic, and economic factors. The study was accomplished in urban slums of Bandra during December 2010 to April 2012. Randomly 10 slums were selected in the area of Urban Health and Training Centre (UHTC), Bandra, under the Grant Govt. Medical College and J.J. Group of Hospitals, Mumbai. House-to-house survey was done to identify the children of underfive age.

### Study population

The study was conducted among the underfive (0–59 months old) children residing in the selected slums along with their mothers. Those study participants who were not residents of the study area, children's mother who was seriously ill and had difficulty in communication, and children with physical deformities that hinder height measurements at the time of data collection were excluded from the study.

### Sample size

Sample size was determined based on a single proportion population formula using  $z^2 \times P \times q/d^2$  considering the following assumptions: 95% confidence level, estimated proportion ( $P$ ) underweight (40%), and with absolute precision of 5%. The calculated sample size was 370. The total number of study participants was 400 children of 0–59 months of age with his/her mother was involved in the study.

### Data collection

Data collection was done in the field by going house-to-house. A structured, pretested questionnaire was administered to the parents by researcher and physical examination of both child and his/her mother was done by researcher alone. Informed consent was obtained by parents and other caretakers. The questionnaire consists of the personal information, socioeconomic class, child health history, and anthropometry.

### Measurements

Anthropometry is a simple valuable tool and the gold standard for evaluating the nutritional status, but it has many limitations.

Adequate precautions are to be taken during measurement and the procedures utilized are to be standardized and checked frequently for accuracy. Bodyweight was measured using a spring balance scale. The shoes or chappals should always be removed and children should be weighed with as little clothing as custom permits. Below the age of two years, a horizontal measuring rod or infantometer is used. Shoes or chappals are removed and the child is placed on the back on a flat surface. For children 24–59 months of age, standing height to the nearest 0.1 cm was measured. Mid-Upper Arm Circumference (MUAC) measured with the help of Shakir's tape. All anthropometric measurements were taken twice, and the average of the two measurements was calculated and recorded. Anthropometric measurements were transformed into Z-scores with the aid of WHO Anthropometric calculator software version 3.2.2. The Z-score values for height for age, weight for age, weight for height, body mass index for age, and mid-upper arm circumference for age based on WHO standard-based results were calculated.

### Ethical considerations

Institutional Ethical Committee approval was obtained before the start of the study. Informed consent was obtained by parents and other caretakers before including the child in the study. Institutional Ethical Committee approval obtained from Grant Medical College, Mumbai & J.J. Group of Hospitals.

### Statistical analysis

Data entry and analysis were done using Excel and SPSS version 20.0, respectively. Anthropometric indices were calculated using the 2006 WHO Anthro 3.2.2 Software. Descriptive analysis was used to describe the percentages and frequency of sociodemographic characteristics and other relevant variables in the study.

## Results

In this study, total 400 underfive children with their mothers were included. Tables 1-4 depict the distribution of characteristics of underfive children, feeding practices and health status of children, sociodemographic factors, and maternal factors, respectively.

Out of 400 study participants, 126 children (31.5%) are <12 months of age, 56.5% and 43.5% are males and females, respectively. Most of the participants (74.7%) are Hindu by religion. Out of 400, 74% of children are born by normal delivery and 51% are born with low birth weight (<2.5 kg).

Only 24% of mothers started initiation of breastfeeding on time; 50% of mothers started weaning on time, whereas 31% weaned early their child. Out of total, 74% of children did not seek medical opinion, only 36% children consumed >90% of RDA, and 37% of children did not complete their primary immunization.

Out of total, 54% of children live in joint family. Most of the families are with 3–6 family members; 55% of families have less than 3 children and 25% are with child spacing of <2 years;

**Table 1: Distribution of Characteristics of children**

Characteristics	Categories	Frequency	Percentage
Age	<12 months	126	31.5
	12-23 months	69	17.2
	24-35 months	84	21
	36-47 months	59	14.8
	48-59 months	62	15.5
Gender	Male	226	56.5
	Female	174	43.5
Religion	Hindu	299	74.7
	Muslim	82	20.5
	Buddhist	19	4.8
Type of delivery	Normal	297	74
	LSCS	103	26
Birth weight	Normal	198	49
	LBW	202	51

LSCS: Lower segment caesarean section; LBW: Low birth weight

**Table 2: Distribution of feeding practices and health status of children**

Characteristics	Categories	Frequency	Percentage
Initiation of breastfeeding	On Time	98	24
	Delayed	302	76
Age at weaning	On-Time	159	50
	Early	99	31
	Delayed	59	19
Duration of breastfeeding	Adequate	55	23
	Inadequate	181	77
No. of hospital admissions	0	275	69
	1	88	22
	2	28	7
	>2	9	2
Seek medical opinion	No	295	74
	Frequently	62	15
	Infrequently	43	11
% of RDA consumed	>90	111	36
	90-70	145	47
	<70	52	17
Primary Immunization	Completed	172	63
	Incomplete	102	37

82% of families are not using any kind of family planning services; and 41% belongs to upper lower class as per modified Kuppuswamy scale.

Out of total, 17% of mothers are <18 years of at the time of marriage and 26% are <20 years of age at the time of childbearing; 14% are still illiterate or with primary education, whereas 87% are not working; and 22% of mother's dietary intake is less than 50% of Recommended Dietary Allowances (RDA), whereas 19% are underweight.

Figure 1 depicts nutritional status of underfive children, exhibiting 40% are underweight, 36% stunted, 25% wasted, 22% undernourished by head circumference for age, 25% undernourished by BMI for age, and 17% undernourished by MUAC for age.

**Table 3: Distribution of sociodemographic factors**

Characteristics	Categories	Frequency	Percentage
Type of family	Nuclear	185	46
	Joint	215	54
Family size	3-6	256	64
	7-10	130	32
	>10	14	4
No. of children	<3	219	55
	≥3	181	45
Child spacing	<2	80	25
	2-4	217	69
	>4	20	6
Family planning practices	Not used	328	82
	Used	72	18
Socioeconomic status	Upper middle	84	21
	Lower middle	151	38
	Upper lower	165	41

**Table 4: Distribution of maternal factors**

Characteristics	Categories	Frequency	Percentage
Maternal age	≤20	9	3
	21-25	181	45
	26-30	153	38
	>30	57	14
Maternal age at marriage	<18	67	17
	18-25	301	75
	>25	32	8
Maternal age at childbearing	<20	104	26
	20-30	288	72
	>30	8	2
Maternal education	Illiterate and Primary	55	14
	Middle and High School	334	83
	Diploma and Graduate	11	3
Maternal employment	Not employed	349	87
	Employed	51	13
Maternal dietary intake % RDA	>70	19	5
	69-50	292	73
	<50	89	22
Maternal nutritional status	Normal	288	72
	Underweight	76	19
	Overweight and Obese	36	9

Table 5 shows the mean Z scores with the 95% confidence interval for various anthropometric measurements.

The Table 6 shows, as per composite index of anthropometric failure (CIAF), overall only 42% children are showing normal nutritional status, whereas 58% of the children were suffering from one or other form of "Anthropometric Failure." Most common is stunting + underweight (16%) followed by wasting + underweight (15.5%) and stunting (14.8%).

Tables 7-9 depicts the various factors significantly associated with underweight, stunting, and wasting in underfive children, respectively.

Family size with more than 10 family members, normal delivery, delayed initiation of breastfeeding maternal education up to primary

**Table 5: Nutritional status (mean Z scores) of children under five years of age**

Nutrition indicators	Mean Z score	95% Confidence interval
Weight for Age	-1.72	-1.84, -1.60
Height for Age	-1.67	-1.83, -1.51
Weight for Height	-1.02	-1.18, -0.85
Head circumference for Age	-0.97	-1.11, -0.83
MUAC for Age	-0.99	-1.11, -0.86
BMI for Age	-1	-1.16, -0.84

**Table 6: Malnutrition status: Composite index of anthropometric failure (CIAF)**

Composite Index of Anthropometric Failure (CIAF)	Number	Percentages
No Failure	168	42
Wasting	14	3.5
Wasting + Underweight	62	15.5
Wasting + Stunting + Underweight	23	5.7
Stunting + Underweight	64	16
Stunting	59	14.8
Underweight	10	2.5
Total	400	100

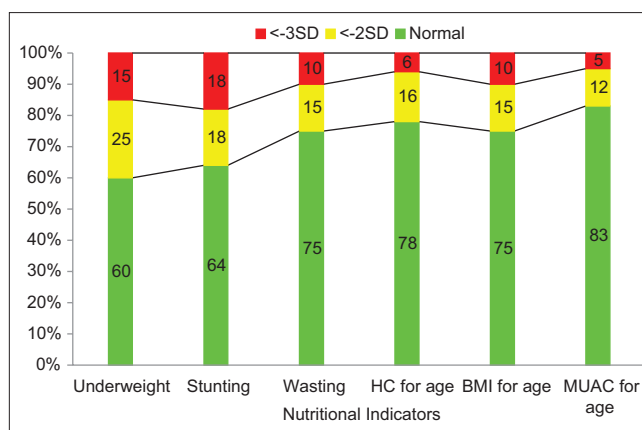
**Table 7: Factors associated with underweight**

Factors	Category	P	X <sup>2</sup>
Family size	3-6	0.02	7.7
	7-10		
	>10		
Type of delivery	Normal	0.02	5.4
	LSCS		
Initiation of breastfeeding	On-Time	0.009	6.8
	Delayed		
Maternal education	Illiterate and Primary	0.001	13.9
	Middle and High School		
	Diploma and Graduate		
Maternal nutritional status	Normal	0.05	4.8
	Underweight		
	Overweight and Obese		
Maternal dietary intake % RDA	>70% RDA	0.03	6.5
	69-50% RDA		
	<50% RDA		

**Table 8: Factors associated with stunting**

Factors	Category	P	X <sup>2</sup>
Age	<12 months	0.001	18.1
	12-23 months		
	24-35 months		
	36-47 months		
	48-59 months		
Birth weight	Normal	0.006	7.6
	LBW		
Seek medical opinion	No	0.03	7
	Frequently		
	Infrequently		

level, poor maternal nutritional status, and <50% of RDA dietary intake are significantly associated with underweight in children.



**Figure 1:** Distribution of children as per nutritional indicators

Children in the age of 1–2 years, LBW (birth weight <2.5 kg), and those who do not seek medical opinion exhibit strong association with stunted children.

Children whose dietary intake is >90% of RDA are showing significantly normal nutritional status, while incomplete primary immunization, maternal education up to primary, employed mothers, and underweight mothers are positive predictors of wasting.

## Discussion

Malnutrition represents one of the main public health problems throughout the world, but most especially in developing countries. According to the World Health Organization, 52 million children under 5 years of age are wasted, 17 million are severely wasted, and 155 million are stunted. Around 45% of deaths among children under five years of age are linked to undernutrition. These mostly occur in low- and middle-income countries.<sup>[6]</sup>

The present study reveals that overall prevalence of malnutrition is 58% with the help of CIAF and 40%, 36%, and 25% of underweight, stunting, and wasting in underfive children, respectively. Family size with more than 10 family members leads to uneven distribution of food; neglect in care of child might be associated with undernutrition. Maternal and childcare in case of cesarean section is taken extensively as compared to normal delivery. Due to delayed initiation of breastfeeding, child is deprived of colostrum, which is rich in protein, immunoglobulins, and various protective antibodies; hence, child is prone for infections, which leads to malnutrition. Maternal education also plays important role in the nutritional status of the child. Maternal nutritional status and dietary intake affect the child nourishment from the day of conception. Children in the age group of 12–23 months have started weaning, inadequate nutrition, and increase activity during this growing age might be the reason of undernutrition. Low birth weight means undernourished since birth, which causes chronic undernutrition, i.e. stunting. Not seeking medical opinion due to poverty and



**Table 9: Factors associated with wasting**

Factors	Category	P	X <sup>2</sup>
% of RDA consumed	>90	0.04	6.4
	90-70		
	<70		
Primary Immunization	Completed	0.05	3.5
	Incomplete		
Maternal education	Illiterate and Primary	0.002	12.4
	Middle and High School		
	Diploma and Graduate		
Maternal employment	Not employed	0.02	4.9
	Employed		
Maternal nutritional status	Normal	0.05	5.3
	Underweight		
	Overweight and Obese		

illiteracy leads to vicious cycle of infection and malnutrition. Primary immunization also plays important role in the vicious cycle of malnutrition and infection.

Khan *et al.* have conducted study in Sindh, Pakistan among underfive children and found that prevalence of stunting, wasting, and underweight were 48.2% (95% CI: 47.1–50.3), 16.2% (95% CI: 15.5–17.9), and 39.5% (95% CI: 38.4–41.5), respectively.<sup>[7]</sup>

Chaudhary and Agrawal, 2019, done study in slums of Jaipur, Rajasthan revealed that prevalence of underweight, stunting, and wasting was 35.7%, 43%, and 10.5%, respectively, and also found that malnutrition was associated with sociodemographic factors such as age, caste, family type, birth weight, birth order, educational profile of parents, and economic status of family.<sup>[8]</sup>

Sarkar in West Bengal revealed stunting (51%) as the most common form of malnutrition among children aged under five, followed by underweight status (41%) and wasting (22%) and also found that age, religion, caste, and birth-order of the child as significant predictors of child's nutritional status.<sup>[9]</sup>

Tamoghna Biswas *et al.* assessed that improper immunization was identified as a risk factor of undernutrition ( $P = 0.049$ ).<sup>[10]</sup>

Irarrázaval *et al.* evaluated 278 infants and children younger than 2 years old, in which 18.35% were underweight, 13.31% stunted, and 13.67% had wasting. Malnutrition was associated with male gender, older age, lower maternal education level, and greater numbers of siblings ( $\chi^2$ ,  $P < 0.05$ ).<sup>[11]</sup>

Gebre *et al.* conducted a study in Ethiopia and revealed that family size of five and above is associated with wasting; increasing age of child and incomplete immunization are strong predictors of stunting and maternal illiteracy with incomplete immunization constitutes underweight.<sup>[12]</sup>

Fosu-Brefo and Arthur studied the effect of breastfeeding on child health in Ghana and results indicate that timely initiation

of breastfeeding, both immediately and hours after birth are important factors that influence the child's health. In addition to this, factors such as the wealth of the household, mother's education, age and size of the child at birth, and age of the mother are important factors that also influence the health of the child in Ghana.<sup>[13]</sup>

## Conclusions

This study reveals very high prevalence of malnutrition status among underfive children of urban slums of commercial capital of India. Incomplete primary immunization, maternal low level of educational status, employed mothers, and undernourished mothers are positively associated with wasting. Large family size, delayed initiation of breastfeeding, maternal illiteracy, undernourished mothers, <50% RDA dietary intake of mothers contribute strongly to underweight in children. Age of child between 12 and 23 months, low birth weight, and not seeking medical opinion are strong predictors of stunting.

## Recommendations

Address the importance of complete immunization, emphasis on maternal education and nutrition, encourage use of family planning, propagandize early initiation of breastfeeding, and publicize the use of medical services. These are the indispensable measures to ameliorate the nutritional status of underfive children.

## Declaration of patient consent

The written and informed consent obtained from the parents/guardian. In the form, the parents/guardian has given their consent for anthropometric measurements and related history. The parents/guardian understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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## Conflict of interest

There is no conflict of interest.

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