Nutritional Status and Determinants of Undernutrition among Under-Five Children in Migrant Populations of Ahmedabad, India: A Community based Cross-Sectional Study

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Abstract:

Introduction: India is one of the largest contributors of child undernutrition globally. A complex relationship exists between migration and undernutrition. **Objectives:** 1. To assess the nutritional status of under 5 migrant children in Ahmedabad. 2. To find out the determinants of undernutrition among migrant children. **Method:** A cross-sectional study was conducted among 668 children (6-59 months) of migrant workers in 171 identified migrant settlements of Ahmedabad. Sampling was done proportionate to population size (PPS) of under 5 migrant children in 7 purposively selected Urban Primary Health Centres (UPHCs) of Ahmedabad. Primary data included anthropometric measurements of children & interviews of primary caregivers. Predictors of undernutrition were determined using logistic regression models. **Results:** The overall prevalence of undernutrition among under 5 migrant children was found to be 71.4%. The study found 300 (44.9%) participants to be underweight while stunting and wasting was present among 283 (42.4%) and 183 (27.4%) participants respectively. Food insecurity was found to be main predictor of wasting (AOR: 2.144, $p<0.001$) and being underweight (AOR: 2.386, $p<0.001$) while increased frequency of illness per year was major predictor for stunting (AOR: 1.745, $p=0.003$). Other important determinants were found to be age, birth weight, birth order, mother's working status, mother's education, socio-economic status, type of migration, number of migrations, immunization, age-appropriate feeding and registration in anganwadi. **Conclusion:** Undernutrition among under 5 children was remarkably high among the migrant population. Multiple factors affect nutritional status of children with increase in frequency of illness and food insecurity being major predictors of undernutrition.

Keywords: Food insecurity, Malnutrition, Migrant

Introduction:

Malnutrition, still remains a major public health concern globally, contributing to nearly half of deaths among children under 5 years of age. Malnutrition, in all its forms, includes undernutrition (wasting, stunting, underweight), inadequate vitamins or minerals, overweight, obesity, and resulting diet-related noncommunicable diseases. In 2022, 149 million children under 5 years of age were estimated to be stunted and 45 million were estimated to be wasted globally.[1] As per National Family Health Survey (NFHS-5) 2019-21, among under 5 years children, India accounted for 35.5% of them to be stunted, 19.3% to be wasted & 32.1% of them still to be underweight.[2] In comparison to the national data, undernutrition among under 5 children is considerably higher in Gujarat with 39% children reported to be stunted, 25.1% wasted and 39.7% underweight as per the survey.[3]

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It has been observed that the malnutrition problem in India is a concentrated phenomenon that is, a relatively small number of states, districts, and villages account for a large share of the malnutrition burden, only 5 states and 50% of villages account for about 80% of the malnutrition burden.[4] Apart from illness, socio-economic status, neglect, abnormal mealtimes, insufficient quantities of food and insufficient parental knowledge, malnutrition can also develop due to repeated, short term and unplanned migration. The developmental, economic, social, and medical impacts of migration related malnutrition are serious and lasting, for individuals and their families, for communities and for countries.[5]

Various studies conducted to examine the nutritional status of children have found a significant association between undernutrition and migration.[6,7] Rapid urban growth and decline in consistent agricultural produce, year after year has forced newly formed households to migrate to lucrative job opportunities at construction sites (road and building), transportation sector and other low-skilled daily wage jobs in cities, often seasonal in nature.[8]

Unplanned migration of this sort along with factors like illiteracy, infectious diseases, food insecurity, lack of understanding about immunization and age-appropriate feeding creates a situation where undernutrition among the children thrives.[9,10] There is a significant gap in the literature, when actual reason behind undernutrition is tried to be identified, especially among those who begin migration early in life, when nutritional insults have a longer-lasting impact.[6]

Objectives:

1. To assess the nutritional status of under 5 migrant children in Ahmedabad.
2. To find out the determinants of undernutrition among migrant children.

Methods:

It was a community based cross-sectional study conducted in migrant settlements of all the 7 zones of Ahmedabad Municipal Corporation (AMC), Gujarat from January 2024 to February 2025. The sample size was calculated using the formula:

$N=4pq/L^2$

where p is the estimated proportion of underweight children (39.7%) as per NFHS 5 – Gujarat factsheet (2019-20)[3] and L represent the relative allowable margin of error (10%) at 95% confidence interval. Taking 10% non-response rate, total sample size was calculated to be 668.

A multistage sampling approach was employed to select the study participants. To meet the sample size, one Urban Primary Health Centre (UPHC) having maximum number of migrant settlements from each zone of AMC was selected purposively. To determine the number of participants to be selected from each UPHC, sampling was done proportionate to population size (PPS) of under 5 migrant children in selected UPHCs of AMC.

Further, from each migrant settlement of the selected UPHC, total number of under 5 migrant children to be included in the study, were calculated using PPS. Lastly, snowball sampling was used to find & select the participants.

Inclusion Criteria:

All the families who self-identified as an interstate migrant and/or fell into the category of migrant as per the study definition; having at least 1 child belonging to the age group of 6-59 months accompanying them were included in the study.

Exclusion Criteria:

Families not willing to give consent were excluded from the study.

Study Variables and Definitions:

In this study, migrants were defined as those families/ households who were living in Ahmedabad away from their usual place of residence (UPR) outside Gujarat for a period > 1 month.

Key variables like short term migrants were defined as those families/ households who were staying away from their UPR for a period greater than 1 month and maximum up to 12 months with at least one return back to home/ have intention to return back within above specified period while long term migrants were defined as those who have migrated from their native place (UPR) and were residing in Ahmedabad for at least 1 year with no intention to return back in near future.[11,12]

Primary outcomes were height-for-age z-scores (HAZ), weight-for-height z-scores (WHZ) & weight for age z-scores (WAZ), which if found below "2 Standard Deviations (SD) of the median of a reference standard as per WHO reference data,[13,14] were declared as stunted, wasted & underweight respectively.

Determinants like food security, was evaluated using Six-Item Short Form Economic research service.[15] Participants reported their household food consumption over the preceding 6 months. The household's raw score was determined using total number of affirmative responses to the six items. A raw score of 0-1 indicated food security. Raw scores of 2-4 and 5-6 were classified as "low food security" and "very low food security," respectively; both were categorized as food insecurity. Other determinants studied included Socio-economic status using BG Prasad classification (Financial year 2023-24, CPI: 138.9)[16], frequency of child's illness per year (Diarrhoea, Acute respiratory infection; ARI)), Immunization status of the child till age was assessed according to Immunization cards or recall by parents.[17,18] Age-appropriate feeding status which was defined appropriate if the child received feeds in accordance to Infant & Young Child feeding (IYCF) & ICMR-NIN guidelines.[19,20]

Study Tool and Data Collection Technique:

Data was collected using face-to-face interviews with primary caretakers, conducted in the local vernacular language using pre-designed and pre-validated questionnaire. All the responses were recorded using pen-and-paper method. Questionnaire was specifically designed to gather information regarding socio-demographic characteristics, migration, illness pattern & determinants of undernutrition among under 5 children. Anthropometric measurements of the children were done using stadiometer or infantometer scale as appropriate, digital weighing scale and MUAC tape.

Prior to data collection, the investigator(s) underwent training in anthropometric measurement techniques as per the World Health Organization (WHO) Multicentre Growth Reference Study guidelines.[14] Measurements were obtained using standardized procedures with children wearing minimal clothing and no footwear. Weight was measured to the nearest 0.1 kg using a digital weighing scale, while length/height was measured to the nearest 0.1 cm using an infantometer or stadiometer, as appropriate for the child's age. MUAC was measured using a non-stretchable MUAC tape at the midpoint of the left upper arm.

The digital weighing scale was calibrated daily before data collection using standard known weights and was checked for a zero reading before each measurement. The infantometer, stadiometer, and MUAC tape were inspected regularly for alignment using rigid steel scale and checked for any signs of damage. To minimize measurement error, duplicate anthropometric measurements were obtained, and if the difference between the two measurements exceeded 0.1 kg for weight or 0.5 cm for length/height, a third measurement was taken. The average of the two closest measurements was used for analysis.

Ethical approval was obtained from Institutional Review Board (IRB) (NHLIRB/2024/January/13/No.9). After securing necessary permissions from health departments of AMC, families were identified and explained about the purpose of the study. Informed consent & assent was obtained followed by interview of parents and anthropometric measurements of the child. In case of presence of more than one child of the required age group in the same household, the youngest child was included in the study purposively.

Data was entered in Microsoft Excel and analysed through IBM Statistical Package for the Social Sciences (SPSS), version 27.

Statistical Analysis:

Descriptive analyses were performed to summarize the sociodemographic characteristics, migration specific details, nutritional status and various determinants of undernutrition. Univariate logistic regression was employed to assess statistically significant associations. All variables with p-value <0.1 in the bivariate analyses for any of the 3 outcomes (stunting, wasting or underweight) were included in the multivariate logistic regression models. Additionally key variables such as age and gender were included irrespective of statistical significance based on epidemiological relevance.

Results:

This study enrolled 668 under 5 migrant children and their primary caregivers for the purpose of the study. Majority of the children (376, 56.2%) completed their first migration before the age of 1 year and resided at or adjacent to construction sites (364, 54.5%).

Table 1 shows the socio-demographic characteristics and factors affecting nutritional status of the participants. The mean age of the children included in the study was 3 years (SD = ± 1.4). Majority of the families enrolled were nuclear (384, 57.5%), belonged to socio-economic class V (467, 69.9%) and were short term migrants (364, 54.5%). In all the families, mothers were the primary caretaker with majority (499, 74.7%) having no primary education.

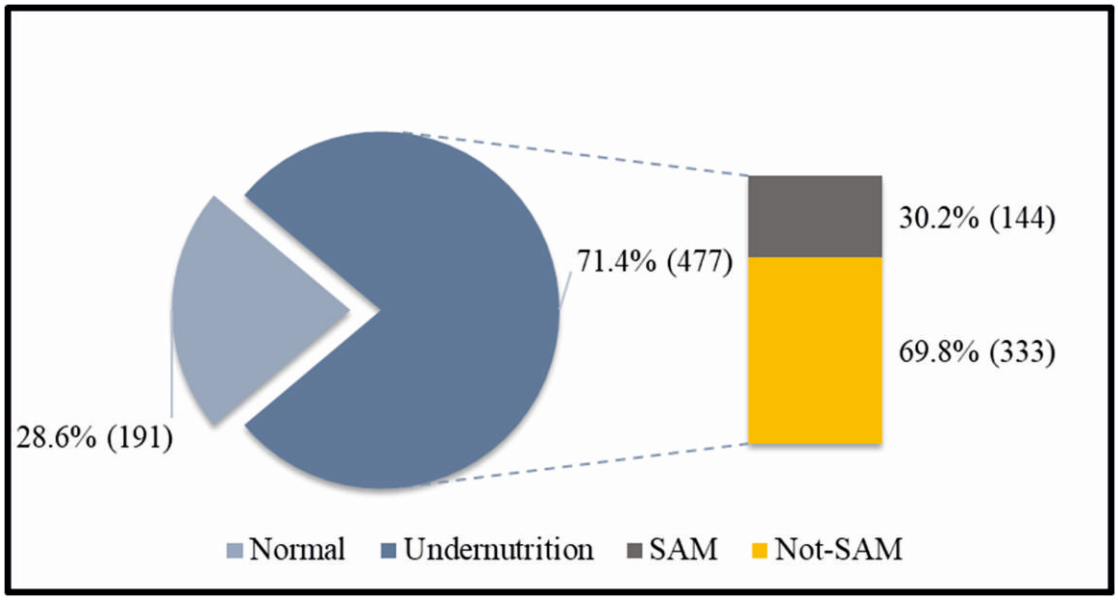
While most of the children (539, 80.7%) had normal birth weight, 129 (19.3%) children were born with low birth weight. Though majority of the children (382, 57.2%) were registered in Anganwadi (ICDS beneficiary), just 345 (51.6%) children were completely immunized as per age. More than 50% of the families (353, 52.8%) were not providing age-appropriate feeding to their children and were food insecure (385, 57.6%).

Table 1: Socio demographic characteristics and factors affecting nutritional status of study participants (N=668)

S.no	Variables	Categories	Frequency, n(%)
1	**Age group of the child (in years)**	≤ 3	239 (35.8)
	Mean age = 3.0 ± 1.4 SD	> 3	429 (64.2)
2	**Gender of the child**	Male	331 (49.6)
		Female	337 (50.4)
3	**Religion**	Hindu	399 (59.7)
		Others	269 (40.3)
4	**Birth weight**	Normal	539 (80.7)
		LBW	129 (19.3)
5	**Birth order**	≤ 2	506 (75.7)
		> 2	162 (24.3)
6	**Mother's Education**	No formal education	499 (74.7)
		Primary education or better	169 (25.3)
7	**Mother's working status**	Working	385 (57.6)
		Not working	283 (42.4)
8	**Family Type**	Joint	284 (42.5)
		Nuclear	384 (57.5)
9	**Socio-economic status**	Class IV or better	201 (30.1)
		Class V	467 (69.9)
10	**Type of migration**	Short-term	364 (54.5)
		Long-term	304 (45.5)
11	**Number of migrations till age**	< 2	285 (42.7)
		≥ 2	383 (57.3)
12	**Food insecurity**	Present	385 (57.6)
		Absent	283 (42.4)
13	**Immunization till age**	Present	345 (51.6)
		Absent	323 (48.4)
14	**Age-appropriate feeding**	Provided	315 (47.2)
		Not provided	353 (52.8)
15	**Frequency of illness per year**	≤ 5 times	384 (57.5)
		> 5 times	284 (42.5)
16	**ICDS beneficiary**	Yes	382 (57.2)
		No	286 (42.8)

ICDS: Integrated Child Development Services, LBW: Low Birth Weight

Graph 1: Nutritional status of the study participants (N=668)



Graph 2: Distribution of participants based on the type of undernutrition (N=668)

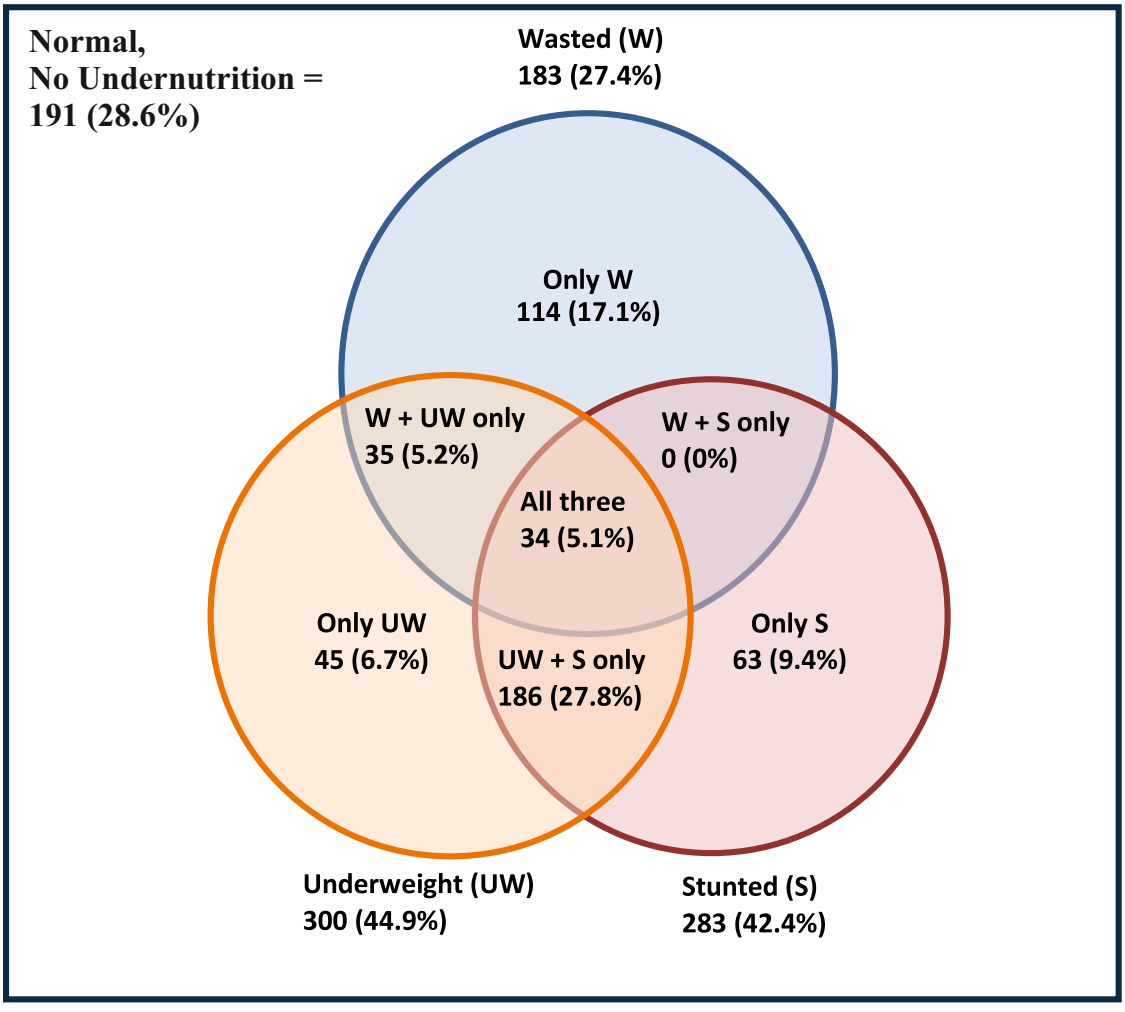


Table 2: Determinants of underweight among under 5 migrant children (N=668)

Variables	Categories	Underweight present, n=300(%)	Underweight absent, n(%)	COR (95% CI)	AOR (95% CI)	p-value
Age group (years)	≤ 3	90 (37.7)	149 (62.3)	1 (Referent)	1 (Referent)	0.016
	> 3	210 (49)	219 (51)	1.588 (1.149-2.193)	1.607 (1.093-2.361)	
Gender	Female	143 (42.4)	194 (57.6)	1 (Referent)	1 (Referent)	0.075
	Male	157 (47.4)	174 (52.6)	1.224 (0.902-1.661)	1.363 (0.969-1.918)	
Birth weight	LBW	70 (54.3)	59 (45.7)	1 (Referent)	1 (Referent)	0.015
	Normal	230 (42.7)	309 (57.3)	0.627 (0.426-0.923)	0.590 (0.385-0.904)	
Birth order	≤ 2	223 (44.1)	283 (55.9)	1 (Referent)	1 (Referent)	0.396
	> 2	77 (47.5)	85 (52.5)	1.150 (0.806-1.639)	1.194 (0.793-1.800)	
Socio-economic status	Class V	227 (48.6)	240 (51.4)	1 (Referent)	1 (Referent)	0.039
	Class IV or better	73 (36.3)	128 (63.7)	0.603 (0.429-0.847)	0.663 (0.411-0.977)	
Mother's Education	No formal education	239 (47.9)	260 (52.1)	1 (Referent)	1 (Referent)	0.545
	Primary education or better	61 (36.1)	108 (63.9)	0.614 (0.429-0.880)	0.883 (0.590-1.321)	
Mother's working status	Not working	139 (49.1)	144 (50.9)	1 (Referent)	1 (Referent)	0.690
	Working	161 (41.8)	224 (58.2)	0.745 (0.547-1.014)	0.920 (0.611-1.386)	
Type of Migration	Short-term	195 (53.6)	169 (46.4)	1 (Referent)	1 (Referent)	< 0.001
	Long-term	105 (34.5)	199 (65.5)	0.457 (0.334-0.626)	0.460 (0.325-0.652)	
Number of migrations till age	≤ 2	107 (37.5)	178 (62.5)	1 (Referent)	1 (Referent)	0.591
	> 2	193 (50.4)	190 (49.6)	1.690 (1.236-2.310)	1.103 (0.770-1.580)	
Immunization till age	Absent	160 (49.5)	163 (50.5)	1 (Referent)	1 (Referent)	0.149
	Present	140 (40.6)	205 (59.4)	0.696 (0.512-0.945)	0.770 (0.541-1.098)	
Food Insecurity	Absent	89 (31.4)	194 (68.6)	1 (Referent)	1 (Referent)	< 0.001
	Present	211 (54.8)	174 (45.2)	2.643 (1.917-3.645)	2.386 (1.638-3.474)	
Frequency of illness per year	≤ 5 times	147 (38.3)	237 (61.7)	1 (Referent)	1 (Referent)	< 0.001
	> 5 times	153 (53.9)	131 (46.7)	1.883 (1.380-2.570)	1.981 (1.383-2.838)	
Age- Appropriate feeding	Not provided	185 (52.4)	168 (47.6)	1 (Referent)	1 (Referent)	0.012
	Provided	115 (36.5)	200 (63.5)	0.522 (0.383-0.712)	0.627 (0.435-0.907)	
ICDS beneficiary	No	142 (49.7)	144 (50.3)	1 (Referent)	1 (Referent)	0.848
	Yes	158 (41.4)	224 (58.6)	0.715 (0.525-0.974)	0.966 (0.679-1.374)	

COR was determined using univariate binary logistic regression. COR: Crude odds ratio, AOR: Adjusted odds ratio, CI: Confidence interval

Table 3: Determinants of wasting among under 5 migrant children (N=668)

Variables	Categories	Wasting present, n=183(%)	Wasting) absent, n (%)	COR (95% CI)	AOR (95% CI)	p-value
Age group (years)	≤ 3	65 (27.2)	174 (72.8)	1 (Referent)	1 (Referent)	0.459
	> 3	118 (27.5)	311 (72.5)	1.016 (0.712-1.449)	1.170 (0.773-1.771)	
Gender	Female	100 (29.7)	237 (70.3)	1 (Referent)	1 (Referent)	0.093
	Male	83 (25.1)	248 (74.9)	0.793 (0.564-1.116)	0.729 (0.503-1.055)	
Birth weight	LBW	33 (25.6)	96 (74.4)	1 (Referent)	1 (Referent)	0.661
	Normal	150 (27.8)	389 (72.2)	1.122 (0.724-1.738)	0.898 (0.556-1.451)	
Birth order	≤ 2	125 (24.7)	381 (75.3)	1 (Referent)	1 (Referent)	0.011
	> 2	58 (35.8)	104 (64.2)	1.700 (1.163-2.484)	1.761 (1.141-2.716)	
Socio-economic status	Class V	126 (27)	341 (73)	1 (Referent)	1 (Referent)	0.438
	Class IV or better	57 (28.4)	144 (71.6)	1.071 (0.741-1.549)	1.202 (0.755-1.916)	
Mother's Education	No formal education	154 (30.9)	345 (69.1)	1 (Referent)	1 (Referent)	0.012
	Primary education or better	29 (17.2)	140 (82.8)	0.464 (0.298-0.722)	0.546 (0.340-0.875)	
Mother's working status	Not working	72 (25.4)	211 (74.6)	1 (Referent)	1 (Referent)	0.633
	Working	111 (28.8)	274 (71.2)	1.187 (0.839-1.679)	1.115 (0.713-1.745)	
Type of Migration	Short-term	114 (31.3)	250 (68.7)	1 (Referent)	1 (Referent)	0.091
	Long-term	69 (22.7)	235 (77.3)	0.644 (0.455-0.912)	0.721 (0.493-1.053)	
Number of migrations till age	≤ 2	59 (20.7)	226 (79.3)	1 (Referent)	1 (Referent)	0.195
	> 2	124 (32.4)	259 (67.6)	1.834 (1.282-2.622)	1.304 (0.873-1.946)	
Immunization till age	Absent	119 (36.8)	204 (63.2)	1 (Referent)	1 (Referent)	< 0.001
	Present	64 (18.6)	281 (81.4)	0.390 (0.274-0.566)	0.487 (0.331-0.716)	
Food Insecurity	Absent	50 (17.7)	233 (82.3)	1 (Referent)	1 (Referent)	< 0.001
	Present	133 (34.5)	252 (65.5)	2.459 (1.698-3.563)	2.144 (1.405-3.270)	
Frequency of illness per year	≤ 5 times	101 (26.3)	283 (73.7)	1 (Referent)	1 (Referent)	0.752
	> 5 times	82 (28.9)	202 (71.1)	1.137 (0.807-1.602)	0.939 (0.636-1.386)	
Age-Appropriate feeding	Not provided	106 (30)	247 (70)	1 (Referent)	1 (Referent)	0.695
	Provided	77 (24.4)	238 (75.6)	0.754 (0.535-1.063)	1.084 (0.724-1.623)	
ICDS beneficiary	No	100 (35)	186 (65)	1 (Referent)	1 (Referent)	0.021
	Yes	83 (21.7)	299 (78.3)	0.516 (0.366-0.728)	0.640 (0.438-0.936)	

COR was determined using univariate binary logistic regression. COR: Crude odds ratio, AOR: Adjusted odds ratio, CI: Confidence interval

Table 4: Determinants of stunting among under 5 migrant children (N=668)

Variables	Categories	Stunting present, n=283(%)	Stunting absent, n(%)	COR (95% CI)	AOR (95% CI)	p-value
Age group (years)	≤ 3	106 (44.4)	133 (55.6)	1 (Referent)	1 (Referent)	0.013
	> 3	177 (41.3)	252 (58.7)	0.881 (0.640-1.213)	0.644 (0.456-0.910)	
Gender	Female	147 (43.6)	190 (56.4)	1 (Referent)	1 (Referent)	0.050
	Male	136 (41.1)	195 (58.9)	0.901 (0.663-1.225)	0.681 (0.463-1.000)	
Birth weight	LBW	56 (43.4)	73 (56.6)	1 (Referent)	1 (Referent)	0.751
	Normal	227 (42.1)	312 (57.9)	0.948 (0.644-1.398)	0.932 (0.604-1.439)	
Birth order	≤ 2	230 (45.5)	276 (54.5)	1 (Referent)	1 (Referent)	0.009
	> 2	53 (32.7)	109 (67.3)	0.583 (0.402-0.846)	0.566 (0.369-0.867)	
Socio-economic status	Class V	218 (46.7)	249 (53.3)	1 (Referent)	1 (Referent)	0.107
	Class IV or better	65 (32.3)	136 (67.7)	0.546 (0.386-0.772)	0.695 (0.447-1.081)	
Mother's Education	No formal education	219 (43.9)	280 (56.1)	1 (Referent)	1 (Referent)	0.450
	Primary education or better	64 (37.9)	105 (62.1)	0.779 (0.545-1.114)	1.167 (0.782-1.743)	
Mother's working status	Not working	152 (53.7)	131 (46.3)	1 (Referent)	1 (Referent)	<0.001
	Working	131 (34)	254 (66)	0.444 (0.324-0.609)	0.397 (0.262-0.603)	
Type of Migration	Short-term	178 (48.9)	186 (51.1)	1 (Referent)	1 (Referent)	0.391
	Long-term	105 (34.5)	199 (65.5)	0.551 (0.403-0.754)	0.861 (0.612-1.212)	
Number of migrations till age	≤ 2	92 (32.3)	193 (67.7)	1 (Referent)	1 (Referent)	0.014
	> 2	191 (49.9)	192 (50.1)	2.087 (1.517-2.871)	1.569 (1.094-2.249)	
Immunization till age	Absent	148 (45.8)	175 (54.2)	1 (Referent)	1 (Referent)	0.188
	Present	135 (39.1)	210 (60.9)	0.760 (0.559-1.034)	0.787 (0.552-1.124)	
Food Insecurity	Absent	90 (31.8)	193 (68.2)	1 (Referent)	1 (Referent)	0.006
	Present	193 (50.1)	192 (49.9)	2.156 (1.565-2.969)	1.694 (1.164-2.465)	
Frequency of illness per year	≤ 5 times	147 (38.3)	237 (61.7)	1 (Referent)	1 (Referent)	0.003
	> 5 times	136 (47.9)	148 (52.1)	1.482 (1.086-2.021)	1.745 (1.213-2.512)	
Age-Appropriate feeding	Not provided	178 (50.4)	175 (49.6)	1 (Referent)	1 (Referent)	0.002
	Provided	105 (33.3)	210 (66.7)	0.492 (0.359-0.673)	0.554 (0.383-0.802)	
ICDS beneficiary	No	132 (46.2)	154 (53.8)	1 (Referent)	1 (Referent)	0.989
	Yes	151 (39.5)	231 (60.5)	0.763 (0.559-1.040)	1.002 (0.704-1.427)	

COR was determined using univariate binary logistic regression. COR: Crude odds ratio, AOR: Adjusted odds ratio, CI: Confidence interval

Graph 1 & 2 demonstrates the nutritional status of the migrant children studied. A large majority of the children (477, 71.4%) were undernourished with 283 (42.4%), 183 (27.4%) and 300 (44.9%) participants found to be stunted, wasted and underweight respectively. Among all the participants, severe acute malnutrition (SAM) was present in 144 (21.6%) children. While majority of the participants had pallor (370, 55.4%), bilateral pedal edema and visible signs of wasting were present in just 21 (3.1%) and 110 (16.5%) children respectively.

Table 2 depicts the predictors of underweight among under 5 migrant children. Migrant children aged more than 3 years had significantly higher odds (adjusted odds ratio [AOR]: 1.607; 95% CI: 1.093-2.361; p=0.016), while children born with normal birthweight (AOR=0.590 ; 95% CI: 0.385-0.904; p=0.015) had significantly lower odds of being underweight. Children belonging to long-term migrant families (AOR=0.460; 95% CI: 0.325-0.652); p<0.001) and class IV or better socio-economic class (AOR=0.663; 95% CI: 0.411-0.977; p=0.039) had significantly lower odds of becoming underweight. Migrant children in families facing food insecurity (AOR=2.386; 95% CI: 1.638-3.474; p<0.001) were significantly more likely to be underweight as compared to their food secure counterparts. Similarly, children who had more than 5 episodes of illness per year (AOR=1.981; 95% CI: 1.383-2.838; p<0.001) had significantly higher chances of being underweight. Furthermore, children who received age-appropriate feeding months (AOR=0.627; 95% CI: 0.435-0.907; p=0.012) had significantly lower odds of being underweight.

Table 3 & 4 depicts the predictors of wasting and stunting among under 5 migrant children respectively. Wasting was significantly higher among children with families facing food insecurity (AOR=2.144; 95% CI: 1.405-3.270; p<0.001) and birth order more than 2 (AOR=1.761; 95% CI: 1.141-2.716; p=0.011). Children who were immunized till age (AOR=0.487; 95% CI: 0.331-0.716; p<0.001), had mothers with primary education or better (AOR=0.546; 95% CI: 0.340-0.875; p=0.012) and were ICDS beneficiaries (AOR=0.640; 95% CI: 0.438-0.936; p=0.021) had significantly lower odds of becoming wasted.

Stunting was significantly higher among children who underwent more than 2 migrations till age (AOR=1.569; 95% CI: 1.094-2.249; p=0.014), had more than 5 episodes of illness per year (AOR=1.745; 95% CI: 1.213-2.512; p=0.003) and belonged to families who were food insecure (AOR=1.694; 95% CI: 1.164-2.465; p=0.006). Migrant children aged > 3 years (AOR=0.644; 95% CI: 0.456-0.910; p=0.013), had birth order >2 (AOR=0.566; 95% CI: 0.369-0.867; p=0.009), had working mothers (AOR=0.397; 95% CI: 0.262-0.603; p<0.001) and received age-appropriate feeding (AOR=0.554; 95% CI: 0.383-802; p=0.002) had significantly lower odds of being stunted.

Discussion:

This study was conducted among the migrant children belonging to the age group of 6 to 59 months in migrant settlements of Ahmedabad which is similar to study conducted by Roshania et al.[6] which focussed on migrant children in brick kilns of Bihar. This study was one of its kind as it provided details about undernutrition among interstate migrants rather than resident citizens of the state.

The mean age of the participants in the present study was 3 years (SD± 1.4) which was similar to the findings by Singh et al.[21] where mean age of the participants was 3.05 years (±SD 1.27) but was in contrast to the findings of the studies conducted by Murarkar et al.[22] and Kachhawala F et al.[23] where mean age of the participants were 2.38 years (±SD 1.36) and 2.75 years (±SD 0.10) respectively. There was a balanced sex distribution among the participants with proportion of females (337, 50.4%) being marginally higher than the males which was in contrast with findings of Chakraborty et al.[24] where proportion of males (50.4%) were higher than the females. In this study, 74.7% of the mothers had no formal education which was in contrast to the findings by Singh et al.[21], Chakraborty et al.[24] and Patra M et al.[25], where mere 5.1%, 4.8% and 32.7%, of the mothers/ primary caretakers had no formal education.

It was observed that the overall prevalence of stunting among migrant children under five years of age was 42.4%, wasting was 27.4% and 44.9% children were underweight, which was comparatively higher than

the city average of 17.5% wasting, 35.5% stunting & 34% underweight respectively.[26] The findings were reasonably different from the studies conducted by Murarkar et al.[22] where 45.9% children were stunted, 17.1% were wasted and 35.4% children were underweight. Present study found 71.4% of the participants to be undernourished which was extremely high when compared to the findings by Farooq U et al.[27] and Garg et al.[28] where 64.2% and 58.2% of the under 5 children were undernourished.

This study found the age of the child to be significantly associated with stunting and underweight; the increase in the former accentuated the odds of underweight, which is congruent to the study results of Chakraborty et al.[24] Higher odds of wasting were found among the children having birth order >2 which was in contrast to the findings by Singh et al.[21] and Murarkar et al.[22], where none of the nutritional parameters had any association with birth order of children. In this study, wasting was found to be significantly higher among the children whose mothers had no formal education which was in line with findings observed by Chakraborty et al.[24]

Children with incomplete immunization till age were found to be significantly prone to wasting in the present study. Singh et al.[21] and Kachhawala F et al.[23], however found complete immunization till age to be a significant predictor of being underweight rather than wasting. This study found food insecurity to be a major predictor of all the 3 forms of undernutrition among under 5 children. Similar findings were observed by Roshania et al.[6] among the circular migrants in brick kilns of Bihar. Present study found migrant children with high frequency of illness per year being more prone to stunting and being underweight which was in line with the findings by Roshania et al.[6] Migrant children who received age-appropriate feeding had significantly lower odds of being underweight and stunted in the present study. Similar findings were observed by Kachhawala F et al.[23], where prevalence of malnutrition was higher among those who received faulty feeding by their caretakers. Further, increased number of migratory episodes significantly increased the chances of stunting among under 5 children. Similar findings were observed by Roshania et al.[6] where child migrants who had migrated multiple times beginning early in life were especially more vulnerable to chronic undernutrition as compared to those children who experienced single migration.

Limitation:

This study focused only on the migrants residing in urban slums and construction sites, thus findings in the study were representative only of the sampled migrant settlements and could not be generalized to all migrants. It was difficult to avoid recall bias, especially while assessing the immunization status of child because majority of the mothers had no formal education and necessary documents. Further, due to statistical constraints, all the postulated factors affecting the nutritional status of children were not studied.

Conclusions:

The study provided an insight into the nutritional status of under 5 migrant children and the predictors of undernutrition among them. This study found high percentage of child migrants (71.4%) to be undernourished. Majority of the participants (44.9%) were underweight while 44.2% were stunted and 27.4% of the participants were wasted. Food insecurity was found to be one of the main predictors of wasting (AOR: 2.144, $p<0.001$) and being underweight (AOR: 2.386, $p<0.001$) while increased frequency of illness per year was found to be the major predictor of stunting (AOR: 1.745, $p=0.003$) among under 5 migrant children.

Recommendation:

d. It is recommended that UPHCs conduct scheduled monthly awareness camps and outreach clinics in migrant settlements for growth monitoring, addressing incomplete immunizations, prompt diagnosis and treatment of common infections and assessing feeding practices among migrant mothers. Migrant specific food support schemes should be devised at destination sites provided parallel to public distribution system (PDS) sites to tackle food insecurity. Mandatory registration of migrant children under ICDS should be ensured with provision of take-home rations.

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