Prevalence of Under Nutrition and its Predictors among Under 5 Year Children in Surat Region, Gujarat, India

Meshram II, Mallikharjun Rao K, Ch Gal Reddy, Ravindranath M, Sharad Kumar S, Sreerama Krishna K, Hari Kumar R, Venkaiah K and Laxmaiah A

Division of Community Studies, National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, India

Corresponding author: Meshram II

✉ indrapal.m@rediffmail.com

Scientist "D", Division of Community Studies, National Institute of Nutrition, Indian Council of Medical Research, Jamai- Osmania (PO), Tarnaka, Hyderabad-500007 , India

Tel: 91-040-270197255
040-27019141

Abstract

Background: Under nutrition continues to be an important public health problem, in spite of several nutrition intervention programs in India. The present study was carried out to know the prevalence of under nutrition among <5 year children.

Objective: To assess nutritional status of <5 year children as well as infant & young child feeding (IYCF) practices among young children.

Design: A community based cross- sectional study using systematic random sampling procedure.

Setting: Surat region of Gujarat.

Participants: Mothers and under 5 year children.

Main outcome: Prevalence of undernutrition and its predictors.

Results: A total of 3133 children (rural: 2600; urban: 533) with mean age 26.2 ± 15.9 months, were covered. The prevalence of underweight, stunting and wasting was 44%, 39% and 22.5% respectively. The prevalence was significantly (p<0.01) higher among rural children (46.7%, 40.3%, & 23.7% respectively) as compared to urban children (32%, 32.5% & 16.4% respectively). The risk of undernutrition was significantly higher among children belonging to ST communities (OR: 1.75, 1.60 & 1.43 respectively) as compared to others, and among children belonging to lower (OR: 1.71, 2.10 & 1.77) and middle (OR: 1.64, 1.83 & 1.41) as compared to high socio-economic groups. The risk of underweight and wasting was 2 times higher among children of illiterate mothers (OR: 1.65 & 1.45 respectively). Among infants, the risk of underweight and stunting was 3 times higher among low birth weight children (<2.5 kg) (OR 2.88 and 2.97), while risk of underweight was 2 times higher among those delivered at home (OR 1.65).

Conclusion: The risk of undernutrition was significantly associated with gender, community, household's wealth and mother's literacy. Thus there is a need to strengthen the existing nutrition intervention programs along with promotion of maternal nutrition, maternal education, and improving households socio-economic and hygienic conditions along with health care services may improve nutritional status of children.

Keywords: Nutritional status; Risk factors; Under 5 children; Antenatal care

Citation: Meshram II, Mallikharjun Rao K, Ch Gal Reddy et al. Prevalence of Under Nutrition and its Predictors among Under 5 Year Children in Surat Region, Gujarat, India. J Clin Nutr Diet. 2016 2:1.

Introduction

Nutritional status of under 5 year children is one of the important indicator of overall development of community and thus country. Children living in rural and tribal areas of India are at high risk of undernutrition because of improper nutrition, sanitation coupled with low hygienic practices and other condition [1].

Children below 5 years of age, pregnant women and adolescent girls are the vulnerable groups for undernutrition in the community. Maternal undernutrition during pregnancy because of lower socioeconomic status, low purchasing power, and poor intake of nutrients results in low birth weight of offspring. Low birth weight is an important determinant of nutritional status of children.

Millennium Development Goals (MDGs) had set the target to halves undernutrition by 2015. National Family Health Survey [2] carried out during 2005-06 reported that the prevalence of underweight was 45% which is considered to be public health problem. National Nutrition Monitoring Bureau (NNMB) also reported high prevalence of underweight (53%) among <5 year children in the rural areas of Gujarat during 2011-12 [3].

In spite of increased food production over the decades in India, along with socio-economic and demographic transition, and the poverty has declined over periods during 2001 to 2011, as reported by National Sample Survey Organization [4], undernutrition still continues to be an important public health problem.

The higher prevalence of undernutrition among children appears to be associated with higher food insecurity, sub-optimal infant & young child feeding practices and high burdens of intestinal, parasitic and other infections. Increase in food insecurity may be because of climate change, increases in food prices coupled with increase inflation [5].

Nutritional status is also influenced by factors such as household income, the skills and capacity of care givers especially mother, use of limited resources for better care of children, as well as local availability of health-care services [1].

Most of the studies carried out in India focus in rural and tribal areas, but few studies in urban slum areas. NNMB also has carried out studies in rural and tribal areas periodically, but not in urban areas. Hence the present study was carried out in rural as well as urban slum areas.

Gujarat is one of the economically progressive states in India in terms of industrial growth and infrastructure development; still the prevalence of undernutrition continues to be high in the state. There are five districts (viz; The Dangs, Surat, Navsari, Valsad and Tapi) in Surat region in Gujarat with predominantly inhabited by different tribal population ranging from 50-100%. The tribes mostly living in this region are chaudri, Kumbhi, Dublas, Kathodis etc. The government is planning to implement interventions to curb undernutrition with focus on high burden districts in the state. Therefore, the present study was carried out to assess prevalence of undernutrition and their predictors among fewer than 5 year children in the Gujarat, India.

Methodology

The study was approved by institutional Ethical Review Board and also Scientific Advisory Committee of National Institute of Nutrition, Hyderabad. Oral informed consent was obtained from the mothers participated in the study.

Sampling design and sample size

It was a community based cross-sectional study carried out by adopting systematic random sampling procedure. Sample size was calculated considering 46% prevalence of underweight (IIPS 2007) (weight for age<Median-2SD) among <5 year children, with 5% absolute precision and 95% confidence interval (CI), a sample size of 375 ~ 400 children per district was required. A total of 2408 HHs (2008 HHs from rural and 400 HHs from urban areas) were covered for the study.

Selection of Anganwadi centres and households

A total of 20 Anganwadi centres (AWCs) from each districts and urban slum areas were selected by adopting systematic random sampling procedure from rural/urban ICDS projects. From each selected AWCs, a total of 20 households (HHs) with at least one index child of <5 years were covered. For this purpose, HHs in the selected AWC was divided into 5 geographical areas, based on natural groups of households/streets/*mohallas,* etc. Households belonging to Scheduled Caste and Scheduled Tribe communities formed one group. From each of these areas, four consecutive HHs were surveyed by selecting a random start, starting from the Northeast corner of the area*.* In the selected HH, all the <5 year children were included in the study.

Collection of data

Data was collected on pretested proforma by post graduate Research Assistants and graduate Field Worker, recruited locally, and were trained and standardized in survey methodologies, by the scientists of National Institute of Nutrition (NIN), Hyderabad. Information on household socio-economic and demographic particulars was collected from all the selected households, using a pre-coded questionnaire. Anthropometric measurements such as length/height (up to nearest 1mm using height/length board) and weight (up to nearest 100g using SECA weighing scale) of the children were measured [6]. History of morbidity such as fever, respiratory infection, diarrhea, etc., if any, during the preceding 15 days of survey was also collected. Maternal particulars such as age, parity, antenatal care (ANC), tetanus toxoid (TT) immunization, receipt of iron & folic acid (IFA) tablets, and particulars of delivery, were collected from mothers of under 6 month children. IYCF practices such as pre-lacteal feeding, time of initiation of breast feeding, feeding of colostrum, duration of exclusive breast feeding and age at initiation of complementary feeding (CF), the type and frequency of CF was assessed for <12 months children.

Birth weight of the children was taken from the records available at home, such as immunization card, hospital discharge card, or mother-child protection card. Birth weight less than 2.5 kg was considered as low birth weight (LBW) [7].

Household wealth was assessed by using principal components

analysis (factor analysis). Household socio-economic and demographic variables such as occupation of parents, per capita income, land holdings, type of house, source of drinking water, electricity, type of cooking fuel, sanitary latrine and separate kitchen were included in the factor analysis which are proxy for wealth assessment. The first two components explained about 45% of the variance and were weighed heaviest [8, 9]. The regression scores from the first component were used to create an index that was divided into tertiles.

Definition

"Household' is defined as those living together under one roof and sharing common kitchen. *'Pucca'* house means walls made up of cement and bricks or stones and Reinforced Cement Concrete roof (RCC), while '*semi pucca* house' is one that has brick or stone wall and tiled or asbestos roof, *'kutcha'* house had mud or thatched walls and thatched or tiled/asbestos roof.

Pre-lacteals are defined as any feeding given to the babies before initiating breastfeeding for the first time after birth [10].

Statistical analysis

The data was scrutinized and entered into the computers at the National Institute of Nutrition (NIN)**,** Hyderabad. The data cleaning was done by carrying out range and consistency checks. Descriptive and advance analytical statistics of the data were carried out using SPSS Windows version 19.0 [11]. Proportion test with 95% CI, bivariate and multivariate logistic regression analysis was carried out to know the important factors associated with under-nutrition. Significance was considered at p<0.05 level.

Nutritional status of children was assessed according to SD classification [12], using WHO standards [13]. Children who were below two standard deviation (SD) of the reference median (<Median-2SD) on the basis of 'weight-for-age', 'height-for-age' and 'weight-for-height' indices were classified as underweight, stunting and wasting respectively, while children who were below 3SD values of the reference median (<Median-3SD) were classified as 'severe underweight', 'severe stunting' and 'severe wasting' respectively. Household wealth was assessed by using principal components analysis (factor analysis).

Results

Coverage particulars

A total of 3133 children (boys: 1594, girls: 1528; rural: 2600, urban: 533), with mean age of 26.2 ± 15.9 months**,** under 5 years were covered.

Socio-economic and demographic profile of study subjects

The details of socioeconomic and demographic particulars are given in **Table 1**. About three fourth (76%) of HHs belonged to ST communities in rural areas, while 82% belonged to other communities in urban areas. About half (50.7%) of HHs were living in *kutcha* houses in rural areas, while 61% were living in *pucca* houses in urban areas. The proportion of illiterate parents was slightly more in rural (14.9% & 19.4%) as compared to urban

(10% & 17%) areas. Only 28% of HHs in rural and 89% in urban areas had access to safe drinking water (tap water). Only 34% of HHs from rural and 87% HHs from urban areas were using sanitary latrine. Average per capita income was low (Rs 1040 ± 1185) in rural as compared to urban (1610 ± 1015) areas **(Table 1).**

Breast-feeding practices among infants

Pre-lacteals such as glucose/plain water, honey, and jiggery, etc were given to 16% of new born. More than half (56%) of mothers initiated breastfeeding (BF) within 1 hour in rural areas, while only 38% does so in urban areas. About 20% and 60% were exclusively breast fed up to 6 months in urban & rural areas respectively. About 70-75% children of 6-11 months received complementary feeding in addition to breast milk, while only 25% received the same at 6 months of age **(Table 2)**.

Morbidities during preceding fortnight

About 24% children had suffered from at least one morbidity (i.e., fever, diarrhea, acute respiratory infection) during the preceding fortnight. The proportion of morbidity was significantly (p<0.01) higher among 12-35 month children (29%) as compared to 36-59 month children (17%).

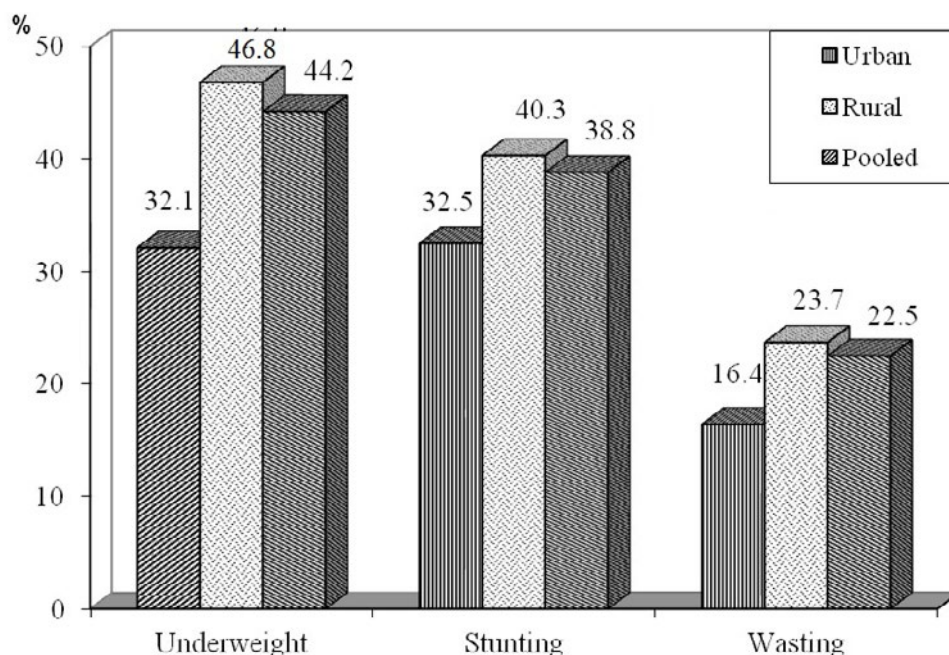## Prevalence of undernutrition by gender and age groups

The prevalence of underweight was 44% (CI=42.5-45.9%) and was higher among boys (45.8%; CI=43.3-48.2%) as compared to girls (42.6%; CI=40.1-45.1%). The overall prevalence of stunting was 39%; CI=37.2-40.6% (Boys; 40.1%; CI=37.7-42.5%, Girls: 37.7%; CI=35.2-40.1%), while that of wasting was 22.5%; CI=21.1-23.9% (Boys: 25.1%; CI=22.9-27.2%, Girls: 19.8%; CI=17.8-21.8%) **(Figure 1)**. The prevalence was significantly (p<0.01) higher among children from rural (46.7%, 40.3%, & 23.7% respectively) as compared to urban areas (32%, 32.5% & 16.4% respectively) **(Figure 1)**. The prevalence of severe underweight, severe stunting and severe wasting was 14%, 12% and 6% respectively.

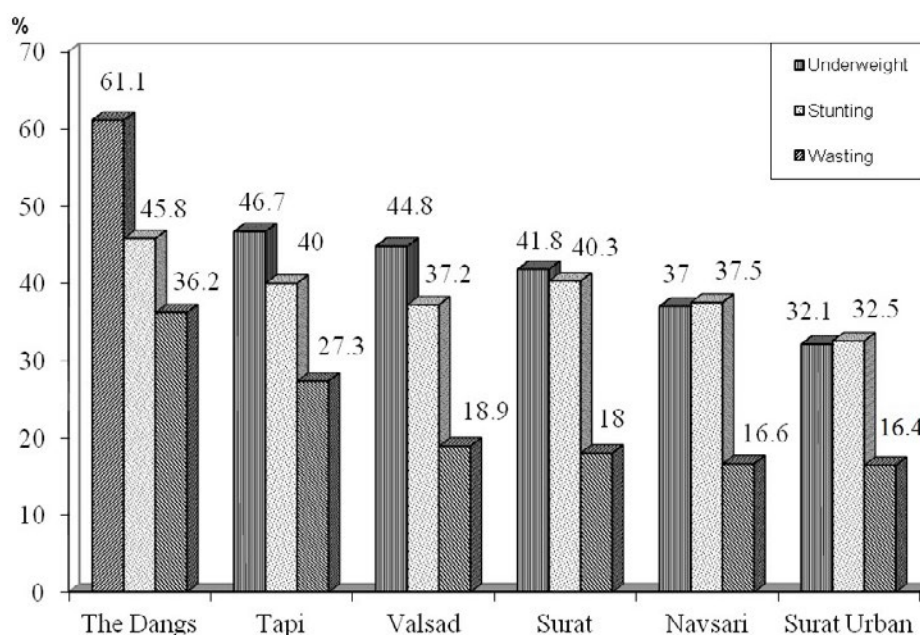## District wise prevalence of under nutrition

The prevalence of under nutrition was higher among children from Dangs district (underweight: 61% CI=57.1-65.1%, stunting: 45.7% CI=41.6-49.8%, wasting: 36.2%, CI=32.4-40.3%), and was lowest in Navsari district (underweight: 36.7%, CI=32.5-41.2%, stunting: 37.4%, CI=33.1-41.8%, wasting: 16.6%, CI=13.5-20.2%) **(Figure 2)**.

Under nutrition vs. socio-economic and demographic variables

Bivariate logistic regression analysis between undernutrition and socio-economic and demographic variables revealed that the risk of underweight and stunting was significantly (p<0.01) higher among children from rural areas, among children belonging to SC and ST communities, among children of nuclear families, children of illiterate parents, and children belonging to lower and middle income groups **(Table 3)**.

Figure 1 Prevalence of under nutrition according to rural urban area.

Figure 2 District wise prevalence of under nutrition among children.

Under nutrition vs. maternal characteristics, ANC, IYCF and hygienic practices

Underweight and stunting was observed to be significantly (p<0.01) associated with age & parity of the mother, number of antenatal care visits, place of delivery, person conducted delivery, birth weight and hand washing practices of mother, while wasting was observed to be significantly associated with hygienic practices of mothers **(Table 4)**.

Stepwise logistic regression analysis for under nutrition as dependent with age and socio-demographic variables as independent variable

Stepwise logistic regression was carried out considering all significant variables in bivariate analysis. The risk of undernutrition was higher among older children (12-59 months) as compared to younger children (0-11 months) and among boys compared to girls. The risk of underweight and stunting was significantly (p<0.01) higher among children from rural areas as compared to

children from urban areas. The risk of underweight and stunting was 2 times higher among children belonging to scheduled tribe community (OR 1.75; CI=1.38-2.2.23 & OR 1.60; CI=1.21-2.13 respectively) compared to others. Children belonging to lower socioeconomic groups (lower wealth index) had 1.7 times higher risk of underweight (or 1.7; CI=1.32-2.22)) and wasting (OR 1.77; CI= 1.30-2.42) as compared to children from high socioeconomic groups. Risk of underweight was 1.7 times higher among children of illiterate mothers (CI=1.27-2.15) and those studied up to 7th standard (OR 1.6; CI=1.25-2.01) as compared to children whose mothers were educated more than 10th class **(Table 5)**.

Among 0-11 month children, the risk of under nutrition was significantly associated with place of delivery, birth weight and hygienic practices. Children born at home had 2 times higher risk of underweight (OR 1.65, 1.08-2.52) as compared to children born in hospitals/health institutions. Low birth weight (<2.5 kg) had 3 times higher risk of underweight (OR 2.88; 1.82-5.54) and stunting (OR 2.97; 1.81-4.74) as compared to normal weight children. Hand washing by mothers with soap before feeding the child was significantly associated with underweight, stunting and wasting with 1.5 to 1.7 times higher risk for children whose mothers did not wash their hands before feeding the child (OR 1.67, 1.73 & 1.5 respectively) **(Table 5)**.

Discussion

Gujarat is one of fastest growing state in the form of the industrial growth and other infrastructural facilities and Surat is commercial hub of Gujarat. However, same is not reflected in terms of nutritional status in Surat region. The study reported that the prevalence of undernutrition was high in rural as compared to urban areas. This may be due to high per capita income and literacy of parents in urban areas as compared to rural areas as well as the proportion of tribal population. The present study reported that the overall prevalence of underweight, stunting and wasting was 44%, 39% and 22.5% respectively, which is similar to the study carried out by NNMB during 2007-09 in tribal areas of Gujarat except prevalence of stunting which was 53% (underweight: 47%, & wasting: 25% respectively) [14]. Meshram et al. reported 64%, 61% and 29% prevalence of underweight, stunting and wasting respectively in the tribal preschool children in Maharashtra [15], while another study carried out by NIN in Madhya Pradesh during 2010 also reported high prevalence of undernutrition among fewer than 5 children in tribal districts [16].

Stepwise logistic regression analysis revealed that the undernutrition was associated with age, gender, community, literacy of mother and wealth index. Lower rates of undernutrition among infants are mostly attributed to the protection offered by breast milk during infancy. High rates of undernutrition in younger children may be due to faulty feeding practices in terms of quantity, quality and frequency of complementary feeding along with higher rates of morbidities among 12-35 month children [17].

Maternal literacy level had significant role in undernutrition. Well educated mothers had efficient management with limited resources, greater health care utilization, better health promoting behavior, low fertility and more child caring practices [18, 19].

Educated girls married lately than non educated girls and mostly engaged in economic activities outside the home, late child bearing, have fewer children and provide better care and nutrition for self and child which reduces the probability of morbidities and hence better survival and nutritional status of their children [20].

HHs wealth index is an indicator of socio-economic development as observed in this study as the risk of undernutrition was higher among children from lower wealth index. Lower socioeconomic status is associated with low literacy, low purchasing power, and food insecurity resulting in higher rates of undernutrition [21]. Also lower SES is associated with less utilization of health care during pregnancy, low nutrient intake and more chances of home delivery, all contributing to higher rates of undernutrition among children.

Prevalence of under nutrition was higher among boys compared to girls. Although the exact mechanism is unclear, it may be due to natural protection offered to female.

Among infants, only place of delivery and birth weight was observed to be associated with under nutrition which is similar to the findings of other studies [22]. Poor maternal nutrition results in low birth weight which is important determinant of undernutrition and morbidity among children.

High prevalence of diarrheal diseases among children is mostly due to low sanitation as observed in the present study where only 34% HHs had sanitary latrine facilities and poor hygienic practices.

Conclusion

The results of the study indicates that undernutrition is still an important public health problem among children in Surat division of Gujarat especially in tribal dominated areas and was significantly associated with gender, community, wealth index and education of mother, as well as place of delivery and birth weight among infants. Strengthening of health care services such as ANC services, promotion of institutional deliveries, strengthening IYCF practices along with improving maternal education, promotion of maternal health, improving socio-economic status of HH by employment opportunities, personal hygiene and sanitation might help to improve nutritional status of children.

Acknowledgement

Funding

Contribution

All the authors were involved in the study design and protocol development. All the authors except 7, 8 & 9 were involved in training to investigators, standardization in data collection and other investigations, execution of survey and supervision. All the authors except 8 were involved in preparation of report. Author 1 prepared a manuscript. Author 8 was involved in statistical analysis. All the authors reviewed the manuscript and approved the final version submitted for publication.

Financial Assistance

Conflict of Interest

There is no conflict of interest between the authors.

Table 1 HHs socio-economic and demographic particulars of study subjects.

Particulars	Rural		Urban	
	n	%	n	%
Community				
ST	1528	76.1	15	3.8
SC	58	2.9	17	4.2
OBC	147	7.3	39	9.8
Others	275	13.7	329	82.2
Type of House				
Kutcha	1018	50.7	38	9.4
Semi Pucca	708	35.3	119	29.8
Pucca	282	14.0	243	60.8
Type of family				
Nuclear	772	28.5	182	45.5
Ext. Nuclear	321	16.0	72	18.0
Joint	1115	55.5	146	36.5
Literacy status of father				
Illiterate	299	14.9	40	10.0
1st–7th standard	530	26.4	155	38.8
8th-10th class	721	35.9	126	31.4
Inter & above	458	22.8	79	19.8
Literacy status of mother				
Illiterate	390	19.4	68	17.0
1st to 7th class	603	30.0	159	39.8
8th-10th class	582	29.0	110	27.4
Inter & above	433	21.6	63	15.8
Land possession (Acres)				
Nil or <2.5	1826	90.9	375	93.8
≥2.5	182	9.1	25	6.3
Occupation of father				
Labour	999	49.8	216	54.0
Cultivators +artisan	453	22.6	43	10.8
Service + business	556	27.7	141	35.2
Occupation of mother				
Labour	552	27.5	65	16.2
Housewife	1382	68.8	319	79.8
Service+ others	74	3.7	16	4.0
Source of drinking water				
River, streams etc.	164	8.2	21	5.3
Open & tube well	1290	64.2	21	5.3
Tap	554	27.6	358	89.5
Cooking fuel used				
Firewood	1508	75.1	60	15.0
Others	500	24.9	340	85.0
Sanitary latrine Present	690	34.4	348	87.0
Electricity Present	1886	93.9	400	100
Separate kitchen Present	1119	55.7	181	45.3
Average per capita income (Rs)	1040 (SD1186)		1610 (SD 1015)	

Table 2 Distribution (%) of feeding practices among 0-11 month children.

Age group 0-11 months	Rural (n=592)		Urban (n=132)
	%		
Colostrum feeding	84.5		80.3
Time of Initiation of breast feeding (Hrs)			
< 1	55.7		37.9
1-3	27.9		29.5
4 – 23	8.2		19.0
≥24	8.2		13.6
Exclusive breastfeeding (0-5 month children)	60.0		20.0
Age group 6-11 months	**343**	**85**	
Current Feeding Practices			
Solely breast fed	10.5		0.0
BF+ water	14.6		27.3
Currently Breast fed + Complementary feeding	74.9		70.6
Not BF	0.0		2.4
Age of initiation of complementary feeding (CF)			
< 6 months	7.0		14.2
6 months	23.9		25.9
7-11 months	43.9		33.0
Not yet started CF	25.2		27.1

Note: CF-complementary feeding

Table 3 Bivariate logistic regression analysis for undernutrition as dependant and socio-economic, demographic factors and type of area as independent variable **(OR with 95% CI)**.

Particulars		n	Underweight	Stunting	Wasting
Type of area	Urban	530	1	1	1
	Rural	2600	1.86, 1.52-2.26*	1.40, 1.15-1.71*	1.58, 1.23-2.02*
Gender	Girls	1528	1	1	1
	Boys	1586	1.13, 0.98-1.31	1.10, 0.95-1.27	1.36, 1.14-1.60*
Community	Others	754	1.0	1.0	1.0
	ST	2042	2.59, 2.16-3.09*	1.97, 1.64-2.35*	2.02, 1.61-2.52*
	SC	96	1.29, 0.83-2.02	1.76, 1.14-2.72*	0.87, 0.43-1.63
	OBC	222	0.72, 0.51-1.02	0.70, 0.49-0.99	0.94, 0.62-1.45
Type of family	Joint	1635	1.0	1.0	1.0
	Nuclear	995	1.26, 1.07-1.48*	1.38, 1.17-1.62*	1.03, 0.85-1.24
	Ext. Nuclear	484	1.15, 0.90-1.36	1.20, 0.97-1.47	1.00, 0.79-1.28
Family Size	1-4	745	1.0	1.0	1.0
	5-9	2129	1.13, 0.82-1.51	1.08, 0.80-1.46	1.12, 0.78-1.59
	≥10	240	1.06, 0.81-1.39	0.98, 0.74-1.29	1.06, 0.77-1.47
Literacy status of father	Inter & above	648	1.0	1.0	1.0
	Illiterate	457	2.17, 1.70-2.77*	2.28, 1.77-2.92*	1.74, 1.30-2.31*
	1-7th class	926	1.69, 1.37-2.08*	1.65, 1.33-2.04*	1.44, 1.29-1.86*
	8th-10th class	1083	1.32, 1.08-1.62*	1.44, 1.17-1.77*	1.18, 0.92-1.52
Literacy status of mother	Inter & above	589	1.0	1.0	1.0
	Illiterate	640	2.50, 1.98-3.17*	2.05, 1.62-2.60*	2.11, 1.58-2.83*
	1-7th class	1012	2.16, 1.75-2.69*	1.79, 1.44-2.23*	1.98, 1.15-2.60*
	8th-10th class	873	1.78, 1.43-2.22*	1.49, 1.19-1.87*	1.85, 1.40-2.49*
Land holding (Acres)	≥5	62	1.0	1.0	1.0
	<5	1445	1.13, 0.67-1.91	1.48, 0.86-2.57	0.74, 0.41-1.33
	Nil	1607	1.41, 0.84-2.38	1.41, 0.81-2.45	0.93, 0.52-1.66
Type of house	Pucca	662	1.0	1.0	1.0
	Kutcha	1391	3.08, 2.51-3.78*	2.28, 1.86-2.80*	2.89, 2.23-3.75*
	Semi Pucca	1061	2.32, 1.87-2.86*	1.99, 1.61-2.46*	1.85, 1.40-2.44*
Sanitary latrine	Present	1730	1.0	1.0	1.0
	Absent	854	1.91, 1.62-2.27*	1.76, 1.48-2.10*	1.57, 1.28-1.93*
Morbidity	Absent	2295	1.0	1.0	1.0
	Present	819	1.05, 0.89-1.23	1.00, 0.85-1.18	1.06, 0.88-1.29
Wealth index	3rd tertile	1049	1.0	1.0	1.0
	2nd tertile	1024	2.47, 2.01-2.89*	1.95, 1.63-2.35*	1.85, 1.47-2.31*
	1st tertile	1041	3.02, 2.52-3.62*	2.46, 2.05-2.95*	2.49, 2.00-3.10*

Note: *significant $p<0.01$

Table 4 Bivariate logistic regression analysis for undernutrition as dependant and maternal particulars, delivery and IYCF practices **as** independent variable among 0-11 month children (OR with 95% CI).

Particulars		n	Underweight	Stunting	Wasting
Age of the Mother (for <5 yr children)	<26	1752	1.0	1.0	1.0
	26-29	891	1.19, 1.01-1.40*	1.19, 1.00-1.39	1.03, 0.85-1.25
	≥ 30	471	1.03, 0.83-1.26	1.14, 0.93-1.41	1.04, 0.82-1.33
Parity (for <5 yr children)	1	1407	1.0	1.0	1.0
	2	1070	1.25, 1.06-1.47*	1.25, 1.06-1.48*	1.21, 1.00-1.47
	3	428	1.17, 0.94-1.45	1.20, 0.96-1.51	1.25, 0.97-1.61
	4	125	1.20, 0.83-1.71	1.32, 0.91-1.91	1.23, 0.72-1.74
	≥ 5	84	2.45, 1.55-3.89*	2.07, 1.33-3.23*	1.74, 1.07-2.82*
Place of delivery	Institution	493	1.0	1.0	1.0
	Home	231	1.86, 1.32-2.62*	1.74, 1.19-2.53*	1.23, 0.84-1.81
Delivery conducted by	Doctor	399	1.0	1.0	1.0
	Elders	123	1.66, 1.06-2.60*	1.68, 1.03-2.75*	0.81, 0.46-1.40
	ANM/LHV	202	1.94, 1.33-2.82*	1.68, 1.10-2.55*	1.50, 1.00-2.26
Interval between last two births (Months)	<24	105	1.14, 0.71-1.85	1.08, 0.64-1.84	1.24, 0.72-2.13
	≥ 24	286	0.89, 0.62-1.28	0.75, 0.49-1.11	1.16, 0.78-1.73
	Primi	333	1.0	1.0	1.0
Number of ANCs	≥ 3	651	1.0	1.0	1.0
	<3 or nil	73	1.89, 1.14-3.12*	1.78, 1.03-3.07*	1.39, 0.79-2.46
Number of IFA tablets consumed	≥ 90	260	1.0	1.0	1.0
	<90	258	1.22, 0.83-1.77	1.36, 0.89-2.08	1.02, 0.67-1.55
	Nil	74	1.35, 0.78-2.83	1.20, 0.64-2.28	0.64, 0.31-1.31
Birth weight (Kg)	≥ 2.5	3434	1.0	1.0	1.0
	<2.5	114	2.69, 1.73-4.19*	2.97, 1.84-4.80*	1.38, 0.84-2.26
	DNK	174	2.26 1.53-3.33*	2.16, 1.39-3.34*	1.10, 0.71-1.72
Time of initiation of breast feeding	<1 hr	330	1.0	1.0	1.0
	1-23 hr	214	0.89, 0.61-1.31	1.55, 1.02-2.36	1.00, 0.65-1.53
	≥ 24 hr	48	1.26, 0.66-2.38	1.88, 0.95-3.73	1.15, 0.55-2.35
Colostrum feeding	Yes	500	1.0	1.0	1.0
	No	92	1.16, 0.72-1.87	1.17, 0.69-1.98	0.90, 0.52-1.58
Type of feeding (0-5 months)	BF	215	1.0	1.0	1.0
	BF+CF	34	1.23, 0.52-2.90	0.88, 0.28-2.69	0.72, 0.26-1.97
Type of feeding (6-11 months)	BF+CF	257	1.0	1.0	1.0
	BF+water	86	1.02, 0.62-1.70	1.27, 0.74-2.16	0.88, 0.49-1.61
Age (months) at complementary feeding (6-11 months)	6-8	227	1.0	1.0	1.0
	<6 & >9 EBF	116	1.02, 0.64-1.62	1.20, 0.73-1.97	0.92, 0.59-1.58
Hand washing before feeding	Yes	527	1.0	1.0	1.0
	No	197	1.97, 1.39-2.81*	1.88, 1.27-2.77*	1.48, 1.00-2.19*

Note: SC-scheduled caste, ST-Scheduled Tribe, OBC-Other Backward Community, ANM-Auxiliary Nurse Midwife, LHV-Lady Health Visitor; EBF-Exclusive Breast Fed, DNK-Do Not Know, IYCF-Infant & Young Child Feeding Practices *significant<0.01

Table 5 Logistic regression analysis for undernutrition as dependant and socio-demographic variables as independent variable among <5 year children.

Particulars		Underweight			Stunting			Wasting		
		OR	95% CI		OR	95% CI		OR	95% CI	
		For <5 year children								
Age	0-11	1.0			1.0			1.0		
	12-35	2.59*	2.12-3.17		3.31*	2.66-4.11		1.39*	1.11-1.74	
	36-59	3.11*	2.51-3.85		3.41*	2.72-4.28		1.01	0.79-1.29	
Gender	Girls	1.0			1.0			1.0		
	Boys	1.24*	1.06-1.43		1.18*	1.02-1.38		1.42*	1.19-1.68	
Community	Others	1.0			1.0			1.0		
	ST	1.75*	1.38-2.23		1.60*	1.21-2.13		1.43*	1.07-1.92	
	SC	1.18	0.74-1.86		1.72*	1.09-2.73		0.85	0.45-1.59	
	OBC	0.72	0.50-1.04		0.76	0.52-1.12		0.96	0.62-1.49	
Wealth index	Highest	1.0			1.0			1.0		
	Lowest	1.71*	1.32-2.22		2.10*	1.63-2.71		1.77*	1.30-2.42	
	Middle	1.64*	1.30-2.08		1.83*	1.44-2.33		1.41*	1.05-1.88	
Literacy status of Mother	HSC & above	1.0								
	Illiterate	1.65*	1.27-2.15			-	-	1.45*	1.06-1.99	
	1-7th class	1.59*	1.25-2.01			-	-	1.49*	1.11-1.99	
	8th-10th Class	1.52*	1.20-1.92			-	-	1.62*	1.22-2.17	
Type of family	Nuclear	-	-	-	1.25*	1.05-1.49		-	-	-
	Ext. nuclear	-	-	-	1.16	0.93-1.44		-	-	-
	Joint				1.0					
Type of area	Urban	1.0			1.0					
	Rural	1.40*	1.06-1.84		1.54*	1.16-2.04		-	-	-
		For 0-11 month children								
Place of delivery	Institution	1.0			-			-		
	Home	1.65*	1.08-2.52		-	-	-	-	-	-
Birth weight (kg)	>2.5	1.0			1.0			-	-	-
	<2.5	2.88*	1.82-5.54		2.97*	1.81-4.74		-	-	-
	DNK	1.48	0.93-2.73		1.85*	1.17-2.91				
Hand washing	Yes	1.0			1.0			1.0		
	No	1.67*	1.14 2.44		1.73*	1.15-2.61		1.50*	1.01-2.23	

Note: HSC-Higher Secondary

*significant p<0.01

References

1   World food insecurity and malnutrition (2013): Scope, trends, causes and consequences.

2   International Institute for Population Sciences: National Family Health Survey (NFHS-3), 2005-06 Mumbai, India (2007): International Institute for Population Sciences (IIPS) and Macro International.

3   National Nutrition Monitoring Bureau (2012) Diet and nutritional status of rural population and prevalence of HTN, DM among adults and infant & young child feeding practices –Report of third repeat survey. National Institute of Nutrition (ICMR), Hyderabad, NNMB Tech. Rep. No.26.

4   National sample survey organization: NSSO survey 1973-2005.

5   Naylor RL, Liska AJ, Burke MB, Falcon WP, Gaskell JC, Rozelle SD, et al. (2007) The ripple effect: biofuels, food security, and the environment. Environment & Policy sustainable development 49: 30–43.

6   Jelliffee DB, Jelliffee EP (1990) Community nutritional assessment. Oxford, Oxford University Press.

7   PO7- Disorders related to short gestation and low birth weight in ICD-10.

8   Rutstein SO, Kiersten J (2004) The DHS wealth index. DHS Comparative Reports No. 6. Calverton, Maryland: ORC Macro.

9   Filmer D, Pritchett LH (2001) Estimating wealth effects without expenditure data–or tears: an application to educational enrolments in States of India. Demography 38: 115-32.

10 World Health Organization (2001) The Optimal duration of exclusive breast-feeding: Report of the expert Consultation of the optimal duration of exclusive breastfeeding. Geneva, Switzerland.

11 SPSS Inc. (2009) The SPSS guide to data analysis (Release 19.0). USA: Chicago.

12 World Health Organization (1983) Measuring change in nutritional status.

13 World Health Organization, Multicentre Growth Reference Study Group (2006) WHO Child Growth Standards based on length/height, weight and age. Acta Paediatr Suppl 450: 76-85.

14 National Nutrition Monitoring Bureau (NNMB) (2010) Diet and nutritional status and prevalence of HTN among adult tribal population –Report of second repeat survey. National Institute of Nutrition (ICMR), Hyderabad, Tech. Rep. No. 25.

15 Meshram II, Arlappa N, Balakrishna N, Laxmaiah A, Mallikharjun Rao K, Gal Reddy CH, Ravindranath M, Sharad Kumar S, Brahmam GNV, et al. (2012) Prevalence and Determinants of Undernutrition and its Trends among Pre-School Tribal Children of Maharashtra State, India. J Trop Pediatrics 58: 125-32.

16 National Nutrition Monitoring Bureau (2011) Assessment of nutritional status of under 5 year children rural children in the districts of Madhya Pradesh-Districts pooled report. National Institute of Nutrition (ICMR), Hyderabad.

17 Ministry of Health and family welfare (2013) Guidelines for optimal infant and young child feeding practices. Government of India.

18 Abuya Ba, Ciera J, Kimani-Murage E (2012) Effect of mother's education on child's nutritional status in the slums of Nairobi. BMC pediatr 12: 80.

19 Frost MB, Forste R, Haas DW (2005) Maternal education and child nutritional status in Bolivia: finding the links. Soc Sci Med 60: 395-407.

20 Murphy E, Carr D (2007) Powerful Partners: Adolescent girls' Education and delayed child bearing. Population Reference Bureau (PRB).

21 Rohner F, Tschannen AB, Northrop-Clewes C, Kouassi-Gohou V, Bosso PE, Mascie-Taylor CG, et al. (2012) Comparison of a possession score and a poverty index in predicting anaemia and undernutrition in pre-school children and women of reproductive age in rural and urban Côte d'Ivoire. Public Health Nutr 15: 1620-1629.

22 Meshram II, Laxmaiah A, Gal Reddy CH, Ravindranath M, Venkaiah K, Brahmam GNV, et al. (2011) Prevalence of undernutrition & its correlates among under 3-year old children in rural areas of Andhra Pradesh, India. Ann Hum Biology 38: 93-101.