ORIGINAL ARTICLE

Regional variation in the prevalence of undernutrition and its correlates among under 5 year children in Western India

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Citation

Article Cycle

Abstract

Background: undernutrition is an important public health problems in India with more than 40% children under 5 years are undernourished. **Objectives**: To assess prevalence of undernutrition, regional variation and its correlates among under 5 year children. **Materials & Methods:** A community-based, cross-sectional study was carried out in all the districts of Gujarat covering all regions, using systematic sampling to assess nutritional status of under 5 year children. Nutritional assessment was done using WHO child growth standard. **Results**: The overall prevalence of underweight, stunting and wasting was 44%, 42% and 20% respectively. The prevalence of undernutrition was significantly (p<0.01) higher in central region '52.4%, 49.1% & 24.2% respectively) as compared to Saurashtra & Kachchh region (31.1%, 34.9%, 12.3% respectively). Minimum dietary diversity was more in Sourashtra region (87%) and low in North region (78%). The odds of undernutrition was significantly higher among children belonging to Scheduled tribe communities (OR: 1.62, 1.46 & 1.61 respectively), children of illiterate mothers (OR: 1.23, 1.24 & 1.18 respectively), among children belonging to lower socio-economic groups (OR: 1.39, 1.23 & 1.18 respectively) and with history of morbidity and hygienic practices of mother. The odds of underweight and stunting was 1.3 times higher among children from households not having sanitary latrine and separate kitchen. **Conclusions**: The prevalence of undernutrition was high in central as compared to Saurashtra & Kachchh region and is associated with community, household income, sanitary latrine and literacy status of mother. Therefore,

multi-component health and nutrition intervention along with improving household income, sanitation and hygiene may help in prevention and control of undernutrition.

Keywords

Undernutrition; Risk factors; Regional variation; Gujarat

Introduction

Undernutrition continues to be an important public health problem in south Asian countries (1) including India in spite of increased food production and several nutrition interventions programs in operation since last 4 decades. Nutritional status of under 5-year children is one of the important indicators of overall development of community and thus country.

Undernutrition is important risk factors for high morbidity and mortality and is responsible for about 45% of deaths among under-five year children globally (2). Sustainable Development goals (SDGs) aims at reducing infant mortality to 25 per 1000 live birth and to achieve food security as a matter of priority and to end all forms of malnutrition by 2030 (3). National Nutrition Mission (NNM) initiated in India in 2018 to control undernutrition aims to reduce stunting, under-nutrition, anemia (among young children, women and adolescent girls) and reduce low birth weight by 2%, 2%, 3% and 2% per annum respectively in order to achieve SDGs (4).

Undernutrition is not uniform throughout the country and varies from state to state and within the states, it varies from region to region based on the extent of development. Children living in rural and tribal areas are at high risk of undernutrition and is directly associated with inadequate dietary intake, and indirectly related to contaminated drinking water, poor sanitation, and hygiene (5). 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 along with inadequate access to clean drinking water, safe sanitation and health services (6). Nutritional status is also influenced by factors such as household income, the skills and capacity of care givers especially mothers, use of limited resources for better care of children, as well as local availability of health-care services (6). Undernourished children, who are not optimally breastfed or suffering from micronutrient deficiencies has substantially lower chances of survival than children who are well nourished. They are much more likely to suffer from a serious infection and to die from common childhood illnesses such as diarrhea, measles, pneumonia and malaria, as well as HIV and AIDS (7).

Gujarat is one of the economically progressive states in India in terms of industrial growth and infrastructure development. There are 4 regions in Gujarat mainly North, Central, South and Saurashtra & Kachchh (8).

North Gujarat Region includes Banaskantha, Patan, Mahesana, Sabarkantha, Gandhinagar and Surendranagar districts. Land productivity is very low in this region. Rainfall is only around 735 mm per annum. The climate is arid to semi-arid and the soil is grey brown coastal alluvium. About 63% of the area is cultivated and a little over a third of this is irrigated.

Central Gujarat comprises of Ahmedabad, Vadodara, Kheda, Anand, Dahod and Panchmahal district. The soils are fine to coarser and are slight to moderate saline having slight sodicity.

South Gujarat region comprises of Surat, Bharuch, Tapi, Narmada, Navasari, Valasad and Dang District. This region is tribal dominated with >60% of tribal population. The area receives about 1800 mm of rainfall and the climate is semi arid dry, sub humid; the soil is deep black, and coastal alluvium. About 43% each of the area is under forests and under cultivation. Irrigation is spread over about 24% of the cultivated area. Surat and Bharuch, has seen rapid industrial development in the recent decade.

Saurashtra and Kachchh region consist of Rajkot, Junagadh, Porbandar, Jamnagar, Bhavnagar, Amreli, & Kachchh district. The region receives 537 mm of rainfall and the climate is semi-arid. About 63% of the land area is cultivated, of which 24% is irrigated. Agricultural productivity is relatively high in Saurashtra. In Kachchh district, the rainfall is only about 340 mm per annum, the climate is dry, semi desert and the soil is grey brown deltaic alluvium. Less than 13% of the area is cultivated, but it is rich in natural resources such as diamond, since ancient times.

Aims & Objectives

To assess nutritional status of under 5 year children in all districts of Gujarat.

Material & Methods

Sampling design and Sample size: It was a community based cross-sectional study carried out by adopting systematic sampling procedure. All the villages in the district form the sampling frame. Sample size was calculated based on prevalence of underweight 45% (9) (weight for age < Median-2SD) among <5 year children, with 5% absolute precision and 95% confidence interval (CI), a sample size required was 380 children per district i.e.~400 children by using the formula

$N=(1.962)*pq/(d^2)$, where p=0.45, q=1-p i.e. 0.55, and d=0.05

Selection of Anganwadi centres village and households

A total of 20 Anganwadi centre (AWCs) villages from each districts were selected by adopting systematic sampling procedure. The villages were arranged in ascending order of their population size and first village was selected randomly and then remaining 19 villages were selected using systematic sampling in order to get equal representation to all villages being selected. In each of the selected AWC village, a total of 20 households (HHs), with at least one index child of <5 years were covered. For this purpose, entire village 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, first HH having less than 5 year child was selected randomly from the north east corner that area and remaining 3 HHs having less than 5 year child were covered contiguously. The same procedure was followed in other areas. In the selected HH, all the <5 year children were covered for the study.

Collection of data: Data was collected on pretested questionnaire by post Graduate Research Assistants and graduate field Worker, recruited locally and trained and standardized in survey methodologies, by the scientists of NIN, Hyderabad. Information on household socio-economic and demographic particulars such as type of house, type of family, education, occupation and income of HHs, sanitary latrine etc. was collected for all the selected households. 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 using standard equipment (10). For children less than 1 year, weight of the mother was taken first and then weight of mother with child was taken and then subtracted the weight of mother to get weight of child. Recumbent length was measured for <2 year children using infanto-meter with minimal clothings. Weight was measured using SECA balance in standing position without chappal/shoes and with minimal clothes.

History of morbidity such as fever, acute respiratory infection (ARI) such as cough & coryza, diarrhoea (loose motions) etc., if any, during the preceding 15 days of survey was also collected. Quality check on anthropometric measurement was carried out by scientist from NIN on sub sample of data for consistency check.

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.

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

Statistical analysis: After scrutiny, data was entered into the computers at the National Institute of Nutrition (NIN), Hyderabad. The data cleaning was done by carrying out range and consistency checks. Data analysis was carried out using SPSS Windows version 19.0. Descriptive analysis, proportion test and multivariate logistic regression analysis was carried out to know the important factors associated with under-nutrition. WHO anthro macro for SPSS was used to compute the median Z scores and to analyze nutritional status of under 5 year children.

Nutritional status of children was assessed according to SD classification (11), using WHO standards (12). 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 below -3SD values of the reference median (<Median -3SD) were classified as 'severe

underweight', 'severe stunting' and 'severe wasting' respectively.

Results

Coverage particulars: A total of 12925 children (boys: 6766; girls: 6159) from 10424 HHs were covered for the study. The mean age of children was 26.3 ±16.2 months.

Socio-economic and demographic profile of study subjects-region wise

About one third (30.6%) of HHs belonged to ST communities, the proportion was higher in South (76%) and Central (30.1%) regions as compared to Saurashtra & Kachchh region (3.9%). About two thirds (68.7%) of HHs were living in pucca houses, which was higher in Saurashtra & Kachchh region (90.5%) as compared to South (47.2%) and Central (57.9%) region. About 16% of fathers and 32% mothers were illiterate; the proportion of illiterate mothers was higher in North & central (37% & 37.7% respectively) region as compared to South (21.9%) region. The proportion of HHs having access to safe drinking water (tap) was higher in Saurashtra & Kachchh region (78.1%) as compared to South (32.4%) and Central (44.8%) region. Sanitary latrine was present in 36% HHs, and was higher in Saurashtra & Kachchh region (51.4%) as compared to other regions (27-32%), while separate kitchen was present in 49% of HHs, and was higher in Saurashtra & Kachchh region (72.4%) as compared to other regions (32-55%). The per capita income was Rs. 1839 in Saurashtra & Kachchh region, while it was Rs. 1010 in Central region (Table 1).

Prevalence of undernutrition by regions and by age and gender

The overall prevalence of underweight, stunting and wasting was 44%, 42% and 20% respectively for the state. The prevalence of underweight, stunting and wasting was significantly (p<0.001) higher among children from Central (52.4%, 49.1% & 24.2% respectively), South (48.4%, 42.6% & 23.3% respectively) and North (45.7%, 43.5% & 19.4% respectively) as compared to Saurashtra & Kachchh region (31.1%, 34.9% & 12.3% respectively) (Table 2). The prevalence of underweight, stunting and wasting was significantly (p<0.001) higher among 12-35 month children (48.5%, 50.2% & 22.3% respectively) and 36-59 month children (50.9%, 46.5% & 18.4% respectively) as compared to 0-11 month children (27.7%, 22.6% & 17.1% respectively). The prevalence of underweight, stunting and

wasting was significantly (p<0.001) higher among boys (45.6%, 44.2% & 21.9% respectively) as compared to girls (42.8%, 40.4% & 17.4% respectively) (Table 2).

Association between undernutrition with socio-economic & demographic variables

The prevalence of underweight, stunting and wasting was significantly (p<0.01) higher among children belonging to ST communities (54.9%, 49.2% & 26.8% respectively) as compared to children from other communities (37.3%, 36.2% & 15.4% respectively). The prevalence of undernutrition was significantly (p<0.001) higher among children living in Kutcha houses, children from nuclear families, among children of illiterate parents, among landless HHs, among children of fathers engaged in labour, children belonging to lower income groups, among HHs without electricity, absence of sanitary latrine & separate kitchen and lack of hand washing practices among mothers before feeding the child (Table 2).

Multivariate logistic regression analysis for undernutrition with socio-demographic variables

Multivariate logistic regression was carried out considering all significant variables. Age and gender were significantly associated with the risk of undernutrition, the risk of underweight, stunting and wasting was significantly higher among older children (OR: 3.12; 3.35 & 1.17 respectively) compared to children below 12 months and among boys (OR: 1.16; 1.20 & 1.35 respectively) as compared to girls. The odds of underweight, stunting and wasting was significantly (p<0.01) higher among children belonging to ST communities (OR for underweight: 1.62; 1.43-1.83, OR for stunting: 1.46; 1.29-1.65 & OR for wasting: 1.61; 1.39-1.85) as compared to children from forward communities. The odds of undernutrition was 1.3 times higher among children of illiterate mothers (OR for underweight: 1.23; 1.10-1.38, OR for stunting: 1.24; 1.11-1.38 & OR for wasting: 1.18; 1.05-1.33) as compared to those of literate mothers. The odds for underweight was 1.10 (CI=1.02-1.22) times higher among children living in kutcha houses and 1.16 (CI=1.06-1.26) times higher among children from nuclear families. The odds of undernutrition was higher among children belonging to lower socioeconomic groups (OR for underweight: 1.39; 1.25-1.54, OR for stunting: 1.23; 1.10-1.36 & OR for wasting: 1.18; 1.04-1.33) as compared to children belonging to high socioeconomic groups. The odds of underweight and stunting was higher among

children from HHs not having facility of sanitary latrine (OR: 1.24 & 1.35 respectively) and not having separate kitchen facility (OR: 1.11 & 1.12 respectively). Children with history of any morbidity such as fever, diarrhea or acute respiratory infection during the previous fortnight had 1.3 times higher risk for underweight, 1.2 times higher risk for stunting and 1.21 times higher risk for wasting. The odds of undernutrition was higher among children whose mothers do not was hand before feeding the child (OR for underweight: 1.19; 1.10-1.29, OR for stunting: 1.15; 1.06-1.24 & OR for wasting: 1.16; 1.05-1.27) ([Table 3](#)).

Discussion

For the first time, we tried to analyze region wise data in Gujarat state. The study showed that the overall prevalence of undernutrition was high in Gujarat state and was higher in central, south and north regions as compared to Saurashtra/kachchh region.

The study also showed that the prevalence of undernutrition was higher among children belonging to under privilege section of society such as those belonging to scheduled tribe community, among children of illiterate parents, among children whose parents were engaged in labour work, children belonging to lower socio-economic status, lack of sanitary facilities and poor hygienic practices among mothers.

Multiple logistic regression analysis revealed that the undernutrition was associated with age, gender, community, type of house, literacy status of parents especially mother, per capita income, separate kitchen, sanitary latrine, morbidity and hygienic practices of mothers. Lower rates of undernutrition among infants are mostly attributed to the protection offered by breast milk during infancy. However, the prevalence of undernutrition increases as age advances may be due to sub-optimal feeding practices in terms of quantity, quality and frequency of complementary feeding and late initiation of complementary feeding, lack of exclusive breast feeding upto 6 months along with higher rates of morbidities among 12-35 month children (13) and exposure to hazardous environmental conditions (14).

Maternal literacy plays an important role in undernutrition as well educated mothers had efficient management with limited resources, greater health care utilization, better health promoting behavior, low fertility and more child caring practices (15,16).

HHs income is an indicator of socio-economic development and hence the risk of undernutrition was higher among children from lower socio-economic group, this may be due to low literacy, low purchasing power, lower sanitation facility and high food insecurity among these households resulting in higher rates of undernutrition (17).

Type of house, sanitary latrine, and electricity are the proxy indicator for socio-economic status. Children living in pucca houses are at lower risk of undernutrition as rates of infections are less. Also, presence of sanitary latrine in a house reduces the chances of diarrheal and other parasitic infestation and thus lower risk of undernutrition. Previous studies carried out by other authors also showed similar findings (18,19).

The prevalence of underweight, stunting and wasting in the present study is lower (44%, 42% & 22% respectively) than that reported by NNMB during 2011-12 in rural areas of Gujarat (52%, 54% & 28% respectively) (20). NFHS-4 survey carried out during 2015-16 in rural areas of Gujarat reported 44%, 43% & 28.5% prevalence of underweight, stunting and wasting respectively, which is similar to our survey except prevalence of wasting which is high in NFHS-4 (21). High prevalence of undernutrition in southern and central region is mostly attributed to high proportion of tribal population, high proportion of kutcha houses, lower per capita income, low coverage for sanitation and drinking water and high prevalence of low birth weight in these regions. Industrial development as well as per capita income is more in Saurashtra and Kachchh region as compared to other regions. (22)

Conclusion

The results of the study indicates that undernutrition is still an important public health problem among children in South, North and Central region of Gujarat and is significantly associated with community, socioeconomic status, education of parents, sanitation and hygiene. Strengthening health care services and child feeding practices along with improving maternal education, promotion of maternal health, personal hygiene and sanitation will help to improve nutritional status of children.

Limitation of the study

Data was obtained from the mothers about the past history, hence recall bias is a major limitation, but

the outcome such as height and weight was measured by trained personnel.

Relevance of the study

The study highlighted high prevalence of undernutrition among under 5 year children in south, north and central region of Gujarat which has more tribal population, low per capita income, low sanitation and safe water facility. More attention has to be given to improve sanitation, hygiene and HH income to improve undernutrition in this region. Also there is a need to improve maternal nutrition to improve birth weight as it is important determinant for undernutrition among children.

Authors Contribution

MII: prepares the manuscript, MII & SRK: carried out data analyses. All other were involved in study design, supervision and critically reviewing the manuscript.

Acknowledgement

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Tables

TABLE 1 REGION WISE DISTRIBUTION (%) OF CHILDREN ACCORDING TO SOCIO-DEMOGRAPHIC PARTICULARS

Particulars	Saurashtra & Kachchh	South	Central	North	Pooled
n	2785	2808	2428	2403	10424
Community					
ST	3.9	76.0	30.1	8.8	30.6
SC	14.3	2.5	8.0	14.1	9.6
OBC	54.6	7.8	27.3	41.4	32.6
Others	27.2	13.7	34.6	35.7	27.2
Type of House					
Kutcha	9.5	52.8	42.1	20.4	31.3
Pucca	90.5	47.2	57.9	79.6	68.7
Type of family					
Nuclear	39.2	29.1	29.7	41.4	34.8
Ext. Nuclear	14.6	15.6	19.2	24.3	18.2
Joint	46.2	55.3	51.2	34.2	47.0
Literacy status of father					
Illiterate	16.8	14.8	15.5	15.3	15.6
1st–7th standard	33.0	26.8	27.9	25.1	28.4
8th-10th class	37.5	36.9	33.9	35.1	35.9
Inter & above	12.7	21.5	22.7	24.5	21.1
Literacy status of mother					
Illiterate	33.9	21.9	37.7	37.3	32.4
1st to 7th class	37.0	31.8	32.7	34.8	34.1
8th-10th class	22.1	28.9	18.7	17.8	22.1
Inter & above	7.0	17.4	10.8	10.1	11.4
Land possession (Acres)					
Nil	63.9	44.2	38.1	49.6	49.2
<5	17.7	53.3	57.0	40.7	41.8
≥5	18.3	2.5	4.9	9.8	9.0
Occupation of father					
Labour	49.7	53.3	52.8	41.5	49.5
Cultivators +artisan	24.4	20.9	23.7	27.6	24.0
Service + business	25.9	25.9	23.5	30.9	26.5
Occupation of mother					
Labour	14.5	26.1	20.3	22.7	20.9
Housewife	82.5	70.5	76.2	74.1	75.9
Service+ others	3.1	3.3	3.5	3.2	3.2
Source of drinking water					

River, streams etc.	8.1	6.6	7.5	8.9	7.7
Open & tube well	13.8	61.0	47.7	31.9	38.6
Tap	78.1	32.4	44.8	59.2	53.7
Cooking fuel used					
Firewood	73.6	78.5	85.7	77.2	78.6
Others	26.4	21.5	14.3	22.8	21.4
Sanitary latrine					
Present	51.4	31.5	27.4	31.7	35.9
Electricity					
Present	98.1	94.6	91.3	89.2	93.5
Separate kitchen					
Present	72.6	54.6	32.4	33.6	49.4
Average per capita income (Rs)	1839	1022	1010	1197	1324

North Gujarat Region: Banaskantha, Patan, Mahesana, Sabarkantha, Gandhinagar, and Surendranagar districts; Central Gujarat Region: Ahmedabad, Vadodara, Kheda, Anand, Dahod and Panchmahal district; South Gujarat region: Bharuch, Narmada, Surat, Tapi, Navasari, Valasad and Dang District; Saurashtra and Kachchh Region: Rajkot, Junagadh, Porbandar, Jamnagar, Bhavnagar, Amreli, & Kachchh district

TABLE 2 ASSOCIATION (%) OF UNDERNUTRITION WITH 95% CONFIDENCE INTERVAL (CI) ACCORDING TO SOCIOECONOMIC AND DEMOGRAPHIC PARTICULARS

Particulars	n	Underweight	Stunting	Wasting
Regions		(CI)		
Saurasthra & Kachchh	3370	31.1 (29.6-32.7)	34.9 (33.3-36.5)	12.3 (11.1-13.4)
South	3577	48.4 (46.7-50.0)	42.6 (40.9-44.2)	23.3 (21.9-24.7)
Central	3114	52.4 (50.7-54.2)	49.1 (47.4-50.9)	24.2 (22.7-25.7)
North	2864	45.7 (43.8-47.5)	43.5 (41.7-45.4)	19.4 (17.9-20.9)
Pooled	12925	44.3 (43.4-45.2)	42.4 (41.5-43.2)	19.8 (19.1-20.5)
p value	0.001	0.001	0.001	
Age groups (months)				
0-11	3111	27.7 (26.1-29.3)	22.6 (21.1-24.1)	17.1 (15.7-18.3)
12-35	5688	48.5 (47.2-49.8)	50.2 (48.9-51.5)	22.3 (21.2-23.4)
36-59	4126	50.9 (49.4-52.4)	46.5 (44.9-8.0)	18.4 (17.2-19.6)
p value		0.001	0.001	0.001
Gender				
Boys	6766	45.6 (44.4-46.8)	44.2 (43.0-45.4)	21.9 (20.9-22.9)
Girls	6159	42.8 (41.6-44.0)	40.4 (39.2-41.6)	17.4 (16.5-18.4)
p value		10.9, 0.001	19.3, 0.001	41.1, 0.001
Community				
ST	4147	54.9 (53.3-56.4)	49.2 (47.6-50.7)	26.8 (25.5-28.1)
SC	1193	40.6 (37.8-43.4)	42.4 (39.9-45.6)	17.0 (14.8-19.1)
OBC	4129	40.4 (38.9-41.9)	40.7 (39.2-42.2)	17.2 (16.0-18.3)
Others	3456	37.3 (35.7-38.9)	36.2 (34.6-37.8)	15.4 (14.2-16.6)
p value		0.001	0.001	0.001
Type of House				
Kutcha	4241	54.3 (52.7-55.7)	49.7 (48.2-51.2)	26.8 (25.5-28.1)
Pucca	8684	39.4 (38.4-40.4)	38.8 (37.7-39.8)	16.4 (15.6-17.2)
p value		0.001	0.001	0.001
Type of family				
Nuclear	4472	47.8 (46.3-49.3)	45.9 (44.4-47.3)	20.8 (19.6-22.0)
Ext. Nuclear	2375	45.3 (43.3-47.3)	43.0 (41-45)	19.3 (17.7-20.8)

Joint	6078	41.3 (40.1-42.5)	39.6 (38.4-40.8)	19.2 (18.2-20.1)
p value		0.001	0.001	0.11
Literacy status of father				
Illiterate	2075	51.3 (49.1-53.4)	51.2 (49.1-53.4)	22.3 (20.4-24.0)
1st–7th standard	3727	48.1 (46.5-49.7)	46.0 (44.4-47.5)	20.7 (19.4-22)
8th- & above	7123	40.2 (39.0-41.3)	37.9 (36.7-39.0)	18.6 (17.6-19.4)
p value		0.001	0.001	0.001
Literacy status of mother				
Illiterate	4356	51.0 (49.5-52.5)	49.4 (47.9-50.9)	22.8 (21.4-23.9)
1st–7th standard	4425	44.4 (42.8-45.7)	42.9 (41.4-44.3)	19.1 (17.9-20.2)
8th & above	4144	37.2 (35.6-38.6)	34.4 (32.9-35.8)	17.4 (16.2-18.5)
P value		0.001	0.001	0.001
Land possession (Acres)				
Nil	6364	43.4 (42.1-44.6)	43.1 (41.9-44.3)	18.2 (17.2-19.1)
<5	5494	48.0 (46.7-49.3)	44.1 (42.7-45.4)	22.6 (21.9-23.7)
≥5	1067	30.2 (27.3-32.8)	29.2 (26.5-31.9)	14.5 (12.4-16.6)
p value		0.001	0.001	0.001
Occupation of father				
Labour	6563	48.8 (47.6-50.0)	47.5 (46.3-48.7)	21.7 (20.6-22.6)
Cultivators+artisan	3067	44.0 (42.3-45.8)	40.4 (38.6-42.1)	19.9 (18.5-21.3)
Service + business	3295	35.4 (33.7-36.9)	34.1 (32.5-35.7)	15.9 (14.6-17.1)
p value		0.001	0.001	0.001
Occupation of mother				
Labour	2697	53.2 (51.3-55.1)	50.9 (49.0-52.7)	23.1 (21.5-24.6)
Cultivators +HW	9828	42.2 (41.2-43.2)	40.4 (39.4-41.3)	19.0 (18.2-19.8)
Service + business	400	35.8 (31.1-40.4)	34.0 (29.3-38.6)	16.8 (13.1-20.4)
p value		0.001	0.001	0.001
Per capita income (tertile)				
1st	4149	53.7 (52.1-55.2)	49.9 (48.4-51.4)	24.3 (22.9-25.6)
2nd	4290	46.1 (44.6-47.6)	44.2 (42.7-45.7)	20.1 (18.9-21.3)
3rd	4486	33.8 (32.4-35.2)	33.5 (32.1-34.9)	15.3 (14.2-16.3)
p value		0.001	0.001	0.001
Electricity				
Absent	896	57.9 (54.7-61.1)	57.3 (54.1-60.5)	25.3 (22.4-28.1)
Present	12029	43.2 (42.3-44.1)	41.3 (40.4-42.2)	19.4 (18.7-20.1)
p value		0.001	0.001	0.001
Separate kitchen				
Absent	6704	50.9 (49.6-52.0)	48.5 (47.3-49.7)	22.9 (21.8-23.8)
Present	6221	37.1 (36.0-38.4)	35.8 (34.6-37.0)	16.5 (15.5-17.3)
p value		0.001	0.001	0.001
Sanitary latrine				
Absent	8488	50 (48.9-51.0)	48.0 (46.9-49.0)	22.3 (21.4-23.1)
Present	4437	33.3 (31.9-34.7)	31.6 (30.3-33.1)	15.0 (13.9-16.0)
p value		0.001	0.001	0.001
Source of drinking water				
Tap	6809	39.4 (38.2-40.6)	39.2 (38.0-40.4)	16.5 (15.5-17.4)
Well water	5120	50.8 (49.4-52.2	46.2 (44.8-47.6)	24.2 (23.0-25.4)
Others	996	43.4 (40.3-46.5)	44.5 (41.4-47.5)	19.5 (17.0-22.0)
p value		0.001	0.001	0.001

Any Morbidity				
Present	3291	48.3 (46.5-50)	45.2 (43.5-46.9)	22.5 (21.1-23.9)
Absent	9634	42.9 (41.9-43.9)	41.4 (40.4-42.4)	18.8 (18.0-19.6)
p value		0.001	0.001	0.001
Hand washing practices of mother before feeding the child				
Yes	7382	40.4 (39.3-41.5)	38.9 (37.8-40.00	17.9 (17.0-18.8
No	5543	49.4 (48.1-50.7)	47.0 (45.7-48.3)	22.3 (21.2-23.4)
p value		0.001	0.001	0.001

TABLE 3 MULTIVARIATE STEPWISE LOGISTIC REGRESSION ANALYSIS FOR UNDERNUTRITION WITH SOCIO-DEMOGRAPHIC AND OTHER VARIABLES

Particulars	Underweight		Stunting		Wasting	
Regions	OR	95% CI	OR	95% CI	OR	95% CI
Saurashtra/Kachchh	1.0		1.0		1.0	
South	1.53***	1.33-1.75	1.08	0.94-1.23	1.49***	1.26-1.77
Central	2.15***	1.95-2.41	1.57**	1.39-1.77	1.94***	1.64-2.20
North	1.77***	1.58-1.98	1.32**	1.17-1.48	1.59***	1.38-1.84
Age groups (months)						
0-11	1.0		1.0		1.0	
12-35	2.74***	2.49-3.03	3.86***	3.49-4.28	1.46***	1.30-1.63
36-59	3.12***	2.80-3.46	3.35***	3.00-3.73	1.17*	1.03-1.33
Gender						
Boys	1.16***	1.07-1.25	1.20***	1.12-1.29	1.35***	1.24-1.48
Girls	1.0		1.0		1.0	
Community						
ST	1.62***	1.43-1.83	1.46***	1.29-1.65	1.61***	1.39-1.85
SC	1.14*	0.99-1.32	1.18*	1.02-1.37	1.18*	0.98-1.42
OBC	1.16**	1.05-1.28	1.12*	1.02-1.25	1.20***	1.05-1.36
Others	1.0		1.0		1.0	
Type of house						
Kutcha	1.11*	1.02-1.22			1.32***	1.19-1.46
Pucca	1.0				1.0	
Type of family						
Nuclear	1.16***	1.06-1.26				
Ext. Nuclear	1.10*	0.99-1.22				
Joint	1.0					
Literacy status of father						
Illiterate	1.07	0.95-1.20	1.18***	1.04-1.32		
1st–7th standard	1.13***	1.03-1.23	1.11*	1.01-1.21		
8th- & above	1.0		1.0			
Literacy status of mother						
Illiterate	1.23***	1.10-1.38	1.24***	1.11-1.38	1.18***	1.05-1.33
1st–7th standard	1.13***	1.03-1.25	1.16***	1.05-1.28	1.07	0.95-1.20
8th- & above	1.0		1.0		1.0	
Occupation of father						
Labour	1.16***	1.04-1.28	1.18***	1.06-1.31		
Cultivators +artisan	1.17***	1.04-1.31	1.13*	1.01-1.26		
Service + business	1.0		1.0			
Land holding						

Nil	-	-	1.29***	1.09-1.52	-	-
<5 acres	-	-	1.23***	1.05-1.44	-	-
>5 acres	-	-	1.0			
Per capita income (tertile)						
1st	1.39***	1.25-1.54	1.23***	1.10-1.36	1.18**	1.04-1.33
2nd	1.24***	1.13-1.37	1.17***	1.07-1.29	1.11	0.97-1.25
3rd	1.0		1.0			
Electricity						
No	-	-	1.20**	1.03-1.39	-	-
Yes	-	-	1.0			
Separate kitchen						
Absent	1.11*	1.02-1.22	1.12***	1.02-1.22		
Present	1.0		1.0			
Sanitary latrine						
Absent	1.24***	1.13-1.37	1.35***	1.21-1.48	-	-
Present	1.0		1.0			
Any Morbidity						
Present	1.29***	1.19-1.41	1.16***	1.06-1.26	1.22***	1.10-1.34
Absent	1.0		1.0		1.0	
Hand washing practices of mother						
Yes	1.0		1.0		1.0	
No	1.19*	1.10-1.29	1.15*	1.06-1.24	1.16*	1.05-1.27
*p<0.05, **p<0.01, ***p<0.001						