

ORIGINAL ARTICLE

Care practices during pregnancy, infant feeding practices and their association with nutritional status of infants in Gujarat, India

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[Abstract](#) | [Introduction](#) | [Methodology](#) | [Results](#) | [Conclusion](#) | [References](#) | [Citation](#) | [Tables / Figures](#)

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Abstract

Background: Infant feeding practices plays an important role in nutritional status of children. **Aims & Objectives:** To assess ante-natal care, delivery and infant feeding practices and their association with nutritional status. **Material & Methods:** A community-based, cross-sectional study was carried out in all the districts using systematic random sampling. Information was collected from the selected household on socio-demographic, delivery and feeding practices and anthropometric measurements were carried out. Nutritional status was assessed using WHO Child Growth Standard. Proportion test, bivariate and multivariate regression analysis was done. **Results:** The overall prevalence of underweight, stunting and wasting was 26%, 21.5% and 16.5% respectively. Logistic regression analysis showed that the risk of underweight and stunting was 1.4-1.5 times higher among infant whose mother had undergone ≤ 3 ANC's or not availed ANC's, 1.4 times higher among infants delivered at home, having morbidity during previous fortnight and 3.6 times higher among low birth weight children. The risk of underweight and wasting was 1.2 times higher among infants with birth interval less than 2 years and 1.3-1.5 times higher among children whose mothers were washing their hands only with water after defecation. **Conclusion:** The undernutrition is associated with ante-natal care, delivery practices, low birth weight and hygienic practices.

Keywords

Ante-Natal Care; Delivery Practices; Breast Feeding; Undernutrition

Introduction

The first two years of life are a critical window for ensuring optimal child growth and development (1). Nutritional deficiency during this period can lead to impaired cognitive development, compromised educational achievement and low income

productivity which become difficult to reverse to later in life. Improving infant and young child feeding (IYCF) practice in children of 0-23 months is therefore critical to improved nutrition, health and development (2-4).

The important child feeding practices comprise of early initiation of breast feeding especially within 1

hour after birth, exclusive breast feeding up to 6 months, timely complementary feeding at 6 months of age, along with minimum dietary diversity, minimum meal frequency and consumption of iron fortified foods.

In developing countries, optimal breastfeeding i.e. breastfeeding within one hour of birth, exclusive breastfeeding up to 6 months, and continued breastfeeding until age 2 or longer – has the potential to prevent 12% of all deaths in children under age 5 (5). Exclusively breastfed children are less susceptible to diarrhoea and pneumonia and are 14 times more likely to survive than non-breastfed children (6). Many studies have shown beneficial effects of breastfeeding on infant mortality, respiratory infections (7), diarrhoea (8), and neonatal sepsis (9,10) and thus nutritional status.

Not only IYCF practices, but maternal nutrition, and ante-natal care practices during pregnancy also plays an important role in nutritional status of children.

Aims & Objectives

1. To assess antenatal care, delivery and infant feeding practices.
2. To assess nutritional status of under 5 years children.

Material & Methods

Study Type: A community based cross-sectional study was carried out by adopting systematic random sampling method. **Study population:** Children less than one year of age and their mothers

Study area: Rural and urban ICDS areas of all the districts of Gujarat. **Study Duration:** The study was carried out during April 2012 to March 2013. **Sample**

size calculation: sample size was calculated based on prevalence of underweight 46% (11) (weight for age < Median-2SD) among <5 years children, with 5% absolute precision and 95% confidence interval (CI), a sample of 375~400 children per district was required. **Inclusion and exclusion criteria:** all the children and mothers who consented for study were included. Those not consented and suffering from chronic illness, and handicap children were excluded from study.

Selection of Anganwadi centres village and households

A total of 20 Anganwadi centre (AWCs) villages from each districts were selected by adopting systematic random sampling procedure. In each of the selected AWCs, a total of 20 households (HHs), with at least

one index child of <5 years were covered by dividing village into 5 geographical areas, based on natural groups of households/ streets/mohallas etc. Households belonging to Scheduled Caste (SC) and Scheduled Tribe (ST) communities formed one group. From each of these areas, four consecutive HHs were surveyed by selecting a random start. In the selected HH, all the <5 years children were covered for the study.

Collection of data: Data was collected on pretested questionnaire by trained staff, from local area having knowledge of Gujarathi language and were standardized in survey methodologies, by the scientists. Information on household socio-economic and demographic particulars such as type of family, type of family, education, occupation and income of HHs, sanitary latrine etc. was collected from 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 and procedure (12). History of morbidity such as fever, acute respiratory infection, diarrhoea etc., if any, during the preceding 15 days of survey was also collected.

Maternal particulars: 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 0-11 months children.

Infant and young child feeding practices (IYCF): IYCF practices such as pre-lacteal feeding, time of initiation of breast feeding, colostrum feeding, duration of exclusive breast feeding and age at initiation of complementary feeding (CF), the type and frequency of CF was assessed for 0-11 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).

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, ‘kutchra’

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.

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

Data 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 (13). Proportion test and multivariate logistic regression analysis was carried out to know the important factors associated with under-nutrition.

Nutritional status of children was assessed according to SD classification (14), using WHO standards (15). 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.

Results

Coverage particulars

A total of 3706 infants (boys: 1983; girls: 1723) were covered, of which 84% were from rural and 16% from urban slum areas. The mean age of children was 6.1 ±3.2 months.

Socio-economic and demographic profile

About 29% of HHs belonged to ST communities (Rural: 34.2%, Urban:3.1%), about 30% each of HHs were living in kutcha & pucca houses, and about half (52%) were joint families. Majority (84.3%) of fathers and 68% mothers were literate and 52% fathers were engaged in labour occupation while 27% were in service. Majority (84%) of mothers were housewife. About 58% of HHs had access to tap water which is safe drinking water; sanitary latrine was available in 40% HHs. The average per capita income was Rs. 1274 ([Table 1A](#) & [Table 1B](#)).

IYCF practices among infants

Only 31% infants received breast feeding within 1 hour after birth (Rural: 31%; Urban: 28.2%). Exclusive breast feeding up to 6 months was 30% (Rural: 41.7%, Urban: 15.9%). Only 41% children of 6-11 month received complementary feeding at 6 months of age (Rural: 37.5%, Urban: 61.4%). Only 43% children of 6-11 months had minimum dietary diversity (Rural: 40.5%, Urban: 56.3%) in the diet.

Prevalence of undernutrition by type of feeding practices

The prevalence of underweight and stunting was observed high among 1-4 months children who were not on exclusive breast feeding as compared to children who were exclusively breast fed, while the prevalence declined from 5th month who received complementary feeding in addition to breast milk as compared to those were exclusively breast fed (Fig 1 & 2).

Prevalence of undernutrition by area of residence and gender

The overall prevalence of underweight, stunting and wasting was 26% (CI: 25-27.8%), 21.5% (CI: 20.2-22.8%) and 16.5% (CI: 15.3-17.7%) respectively and was similar in both the gender except prevalence of stunting. The prevalence was significantly higher among children from rural (27.7%, 22.6% & 17% respectively) as compared to urban children (19.6%, 16.2% 13.8% respectively) ([Table 2A](#) & [Table 2B](#)).

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 (35.7%, 28.2% & 22.8% respectively) as compared to children from forward communities (21.4%, 17.5% & 13.8% respectively) and among children living in Kutcha houses as compared to children living in pucca houses. The prevalence of underweight and stunting was significantly ($p<0.01$) higher among children from nuclear families, children of illiterate parents, and among children from landless HHs. The prevalence of underweight, stunting and wasting was significantly ($p<0.01$) higher among children of fathers engaged in labour as compared to those engaged in service, children belonging to lower income groups (below first tertile), among children from HHs without electricity, sanitary latrine & separate kitchen and history of morbidity during previous fortnight ([Table 2](#)).

Undernutrition vs. maternal characteristics, ANC, IYCF and hygienic practices

Bivariate analyses showed that the risk of underweight and stunting was significantly ($p < 0.01$) higher among children whose mothers had undergone ≤ 3 ANCs or not undergone ANC, registered for pregnancy after first trimester or not registered, children whose mothers consumed less than 90 IFA tablets or not consumed at all during last pregnancy, children with birth order 4 & above, among children with birth interval less than 2 years, among children delivered at home, and children with low birth weight. The risk of underweight and stunting was also observed to higher among children who received breast feeding after 24 hours of birth, among children whose mothers do not use soap for washing their hands after defecation ([Table 3](#)).

Association of Maternal education, occupation with ANC, delivery and IYCF practices: The practices of early registration during pregnancy, availing ≥ 4 ANCs, consumption of ≥ 90 IFA tablets, age appropriate feeding, initiation of breast feeding within 1 hour after birth, Institutional deliveries, low birth order and more birth interval were observed to be higher among educated and those engaged in service as compared to illiterate mothers, also prevalence of low birth weight was low among educated and those engaged in service ([Table 4](#)).

Multiple logistic regression analysis for undernutrition with ANC, delivery and hygienic practices

Stepwise logistic regression was carried out considering all significant variables in bivariate analysis keeping age and gender constant. The risk of underweight was 1.5 times higher among children whose mothers did not avail ANC (OR 1.52; 1.05-2.20) or availed ≤ 3 ANCs (OR: 1.50; 1.26-1.78), while stunting was 1.4 times higher among children whose mothers availed ≤ 3 ANCs (OR:1.45; 1.21-1.74). Children delivered at home had 1.4 times higher risk of underweight (OR 1.34, 1.12-1.62) and stunting (OR 1.38; 1.14-1.68) as compared to children born in hospitals/health institutions. Low birth weight (< 2.5 kg) children had 3.6 times higher risk of underweight (OR 3.59; 2.94-4.39) and stunting (OR 3.59; 2.92-4.42) as compared to children with birth weight ≥ 2.5 kg. History of morbidity during previous fortnight had 1.4 times higher risk of underweight (OR 1.42, CI: 1.20-1.67) and 1.3 times risk of stunting (OR 1.34; 1.12-1.59). The risk of underweight was 1.5 times higher among children whose mother does not wash

hands with soap after defecation (OR 1.46; 1.23-1.73) and stunting (OR 1.44; 1.20-1.73). Discarding first secretion (colostrum) after birth was observed to be associated with 1.2 times risk of stunting (OR 1.22; 1.01-1.48). The risk of wasting was also higher among children whose mothers undergone < 4 ANCs (OR:1.33; 1.09-1.62), 2 times higher among children whose birth weight was < 2.5 kg (OR 1.87; 1.48-2.36) and 1.3 times higher among children whose mother does not wash hands with soap after defecation (OR 1.26; 1.04-1.54) ([Table 5](#)).

Discussion

The World Health Organization (16) developed a set of core indicators to assess IYCF practices such as timely initiation of feeding of solid and semi-solid foods from age 6 months and to improve the quantity and quality of foods children consume, while maintaining breast feeding (16,17). There is strong evidence that the promotion of appropriate complementary feeding practices reduces the incidence of stunting and leads to better health and growth outcome (18) as is observed in the present study.

The study reported that the prevalence of underweight, stunting, and wasting was 26%, 22.5%, and 16.5%, respectively, which is lower than that reported by the National Family Health survey (underweight, 29.8%; stunting, 27.5%, wasting 20.3%) among children younger than 12 months in Gujarat (11). A study carried out by the National Nutrition Monitoring Bureau during 2009-2011 in rural areas of Gujarat reported similar prevalence of underweight (26.4%), but stunting (36.8%) and wasting (28.7%) was observed high among infants (19). Lower prevalence of undernutrition during early infancy (0-5 months) may be a result of protection offered by breast-feeding during the first 6 month of life. Higher prevalence of underweight and stunting among 6- to 11-month-old infants could be attributed to suboptimal feeding practices, such as initiation of CF too early or too late and higher rates of infection as a result of unhygienic practices, as observed in the study.

Although no significant association was observed between breast-feeding practices and undernutrition in the present study in multivariate analysis, as was observed in our previous study (20), but was significant in bivariate analysis. Several studies conducted elsewhere on factors associated with appropriate feeding practices among 6-23

month children showed positive association with high maternal and paternal education, better household wealth, exposure to media, adequate antenatal and postnatal contacts, child age and sex, institutional delivery, low parity, maternal occupation, urban residence, knowledge and frequency of complementary feeding and receiving feeding advice in immunization as determinant for appropriate complementary feeding (21).

Chaudary *et al* (2016) (22) observed factors such as not giving colostom, not giving EBF, duration of feedings, swapping the breast during each feed, decreased frequency of feed during illness were associated with poor nutritional status. However, the possible confounding effect of education of mother, and number of antenatal visits, need to be taken into consideration. Study by Meshram *et al* (2014) (23) showed that the better ANC practices are associated with literacy of mother, while feeding practices were associated with literacy of mother, place of delivery and parity.

In another study by Oyda A (24) showed that the children poor feeding practices (low feeding index tertile) were 2.4 times more likely to be underweight as compared to children having medium child feeding practices (medium feeding index tertiles), and children with good child feeding practices (high feeding index tertile) were 55% less likely to be stunted as compared to children belonged to medium child feeding practices.

Ante-natal care during pregnancy, place of delivery and birth weight were observed to be significantly associated with undernutrition as observed in our previous study in Madhya Pradesh (23). Regular ANCs and consumption of IFA tablets during pregnancy lowers the risk of anemia and also helps in early detection of complication during pregnancy. Hong *et al* observed a significant association between ANCs and nutritional status of children (25). Maternal education and occupation plays an important role in these practices as observed in this study similar to study by liaquat *et al*. (26). Educated mothers had the better knowledge and utilize these services in resource poor setting also, hence education of girls are very important in order to prevent and control undernutrition among children. Nutritional status of mother during pregnancy is an important determinant of low birth weight and undernutrition among children. we don't have data on nutritional status of women in this study, but the

study carried out by NNMB (19) in rural areas of Gujarat reported that 35% NPNL and 42% of lactating women 18-59 years were undernourished (BMI<18.5).

There is sufficient evidence of cause affect for certain preventive interventions such as exclusive breast feeding in the first six months in the prevention of diarrhea, pneumonia, and neonatal sepsis; complementary feeding in preventing diarrhea, pneumonia, measles and malaria; and Vitamin-A in prevention of diarrhea (5). Interventions including breast feeding, complementary feeding, Vitamin A and Zinc supplementation could save about 25% of total deaths among under five children. Breast feeding alone has been shown the child mortality declining by 13%. Infants below five months who are not breast fed have higher risk of dying as compared to the counterparts who are breast fed (5). A study by Molla *et al* (2017) revealed that exposure to public media, occupation of mothers, decision making role on use of family income and use of postnatal care services were found to be independent predictors of complementary feeding practices (18).

Conclusion

It is observed that maternal education and occupation plays an important role in availing ANC practices and optimum feeding practices and these practices were observed to be significantly associated with nutritional status of children. It was also observed that complementary feeding along with breast milk from 5th month onwards and dietary diversity was associated with decline prevalence of underweight and stunting.

Recommendation

At least 4 antenatal care checks-ups and institutional delivery should be encouraged. Optimal feeding with dietary diversity will be helpful in improving nutritional status of infants.

The strength of study lies in its large sample size representative of population and data collection being carried out by trained staff.

Limitation of the study

Most of the information was obtained from the mother and thus chances of recall bias are there. Also we have not collected dietary intake and maternal nutrition data which are also important factors associated with undernutrition among children.

Relevance of the study

Ante-natal care practices during pregnancy such as early registration, at least 4 ANC visits, consumption of at least 90 IFA tablets and Institutional deliveries are important determinants of infant nutrition.

Authors Contribution

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

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Tables

TABLE 1A DISTRIBUTION (%) OF 0-11 MONTHS CHILDREN ACCORDING TO SOCIO-DEMOGRAPHIC PARTICULARS

Particulars	Rural (%)	Urban (%)	Pooled (%)
n	3119	588	3706
Community			
ST	34.2	3.1	29.2
SC	8.0	18.7	9.7
OBC	33.3	24.7	32.0
Others	24.5	53.6	29.1
Type of House			
Kutchha	33.7	8.3	29.7
Semi Pucca	41.7	36.9	40.9
Pucca	24.6	54.8	29.3
Type of family			
Nuclear	28.5	35.2	29.6
Ext. Nuclear	18.0	20.4	18.3
Joint	53.5	44.4	52.1
Literacy status of father			
Illiterate	16.9	9.5	15.7
1st-7th standard	28.2	32.3	28.9
8th & above	54.9	58.2	55.4
Literacy status of mother			
Illiterate	34.8	19.9	32.4
1st to 7th class	34.0	37.4	34.5
8th & above	31.3	42.7	33.1
Land possession (Acres)			
Nil	48.0	94.6	55.4
<5	44.1	4.4	37.8
≥5	7.9	1.0	6.8
Occupation of father			
Labour	51.7	55.6	52.3
Cultivators +artisan	23.7	6.0	20.9
Service + business	24.6	38.4	26.8
Occupation of mother			
Labour	14.5	5.6	13.1
Housewife	83.4	92.2	84.8
Service+ others	2.1	2.2	2.1

ANC-ante-natal check-up, IFA-iron & folic acid tablets, CF-complementary feeding

TABLE 1B CONTINUE DISTRIBUTION (%) OF 0-11 MONTHS CHILDREN ACCORDING TO SOCIO-DEMOGRAPHIC PARTICULARS

Particulars	Rural	Urban	%
Source of drinking water			
River, streams etc.	7.5	3.4	6.9
Open & tube well	40.5	4.8	34.9

Tap	52.0	91.8	58.3
Cooking fuel used			
Firewood	81.4	24.8	72.4
Others	18.6	75.2	27.6
Sanitary latrine			
Present	31.7	84.0	40.0
Electricity			
Present	93.4	99.5	94.4
Separate kitchen			
Present	52.5	44.6	48.8
Average per capita monthly income (Rs)			1274

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

Particulars	n	Underweight	Stunting	Wasting
Gender				
Boys	1983	27.0 (25-28.9)	23.2 (21.3-25.1)	17.1 (15.4-18.8)
Girls	1723	25.6 (23.5-27.6)	19.7 (17.8-21.6)	15.8 (14.1-17.5)
Pooled	3706	26.4 (25-27.8)	21.5 (20.2-22.8)	16.5 (15.3-17.7)
p value		NS	0.01	NS
Area				
Rural	3118	27.7 (26.1-29.3)	22.6 (21.1-24.1)	17.0 (15.7-18.3)
Urban	588	19.6 (16.4-22.8)	16.2 (13.2-19.2)	13.8 (12.8-18.7)
p value		0.001	0.001	0.001
Community				
ST	1085	35.7	28.2	22.8
SC	361	22.4	21.3	12.2
OBC	1183	23.6	19.3	14.4
Others	1077	21.4	17.5	13.8
p value		0.001	0.001	0.001
Type of House				
Kutcha	1101	34.6	28.9	22.6
Semi pucca	1518	26.5	20.6	14.9
Pucca	1087	17.9	15.5	12.5
p value		0.001	0.001	0.001
Type of family				
Nuclear	1097	28.4	22.1	18.2
Ext. Nuclear	680	27.6	23.4	17.3
Joint	1929	24.8	20.6	15.2
p value		0.001	0.001	0.11, NS
Literacy status of father				
Illiterate	582	31.4	26.9	18.3
1st-7th standard	1070	29.5	23.0	17.0
8th- & above	2054	23.3	19.3	15.8
p value		0.001	0.001	0.32, NS
Literacy status of mother				
Illiterate	1202	30.0	25.2	18.4
1st-7th standard	1278	26.1	20.6	14.3
8th & above	1226	23.2	18.9	16.9
p value		0.001	0.001	0.01
Land possession (Acres)				
Nil	2052	24.8	20.1	15.8
<5	1403	29.9	24.7	18.2

≥5	251	19.9	16.0	12.4
p value		0.001	0.001	0.03

TABLE 2B CONTINUE ASSOCIATION (%) OF UNDERNUTRITION ACCORDING TO SOCIOECONOMIC AND DEMOGRAPHIC PARTICULARS

Particulars	n	Underweight	Stunting	Wasting
Occupation of father				
Labour	1938	28.1	22.8	17.9
Cultivators+artisan	775	26.2	21.9	15.2
Service + business	993	23.3	19.0	14.8
P value		0.02	0.05	0.05
Occupation of mother				
Labour	486	33.3	28.0	18.1
Cultivators +HW	3141	25.4	20.8	16.1
Service + business	79	24.1	10.1	21.5
P value		0.001	0.001	NS
Per capita income (tertile)				
1st	1079	34.0	26.8	20.4
2nd	1257	26.6	23.1	16.4
3rd	1370	20.2	16.0	13.5
P value		0.001	0.001	0.001
Electricity				
Absent	209	35.4	32.5	15.4
Present	3497	25.9	20.9	16.5
p value		0.001	0.001	NS
Separate kitchen				
Absent	1898	30.8	25.1	18.6
Present	1808	21.8	17.8	14.2
p value		0.001	0.001	0.001
Sanitary latrine				
Absent	2223	31.3	25.7	18.2
Present	1483	19.1	15.3	13.9
p value		0.001	0.001	0.001
Morbidity				
Present	1092	30.9	25.0	17.6
Absent	2614	24.5	20.1	16.0
p value		0.001	0.001	NS

TABLE 3 BIVARIATE ANALYSES FOR UNDERNUTRITION WITH IYCF PRACTICES AMONG INFANTS

Particulars	Underweight	Stunting	Wasting
Age of the mother			
18-30	1.0	1.0	1.0
>30	1.08 (0.92-1.32)	1.05 (0.80-1.37)	0.98 (0.72-1.32)
Number of ANC undergone			
≥4	1.0	1.0	1.0
<4	1.75 (1.49-2.06)	1.64(1.38-1.94)	1.47 (1.21-1.78)
No ANC	1.99 (1.40-2.83)	1.56 (1.07-2.30)	1.68 (1.11-2.52)
Weeks of Registration of pregnancy			
≤12 weeks	1.0	1.0	1.0
13-36 weeks	1.37(1.15-1.63)	1.47 (1.23-1.77)	1.40 (1.14-1.71)
Not registered	1.80 (1.27-2.56)	1.47 (1.01-2.16)	1.62 (1.07-2.43)
Number of IFA tablet consumed			
<90	1.36 (1.16-1.58)	1.36 (1.15-1.61)	1.18 (0.99-1.42)

Not consumed	1.18 (0.92-1.50)	1.07 (0.82-1.40)	1.05 (0.78-1.41)
≥90	1.0	1.0	1.0
Birth order			
1& 2	1.0	1.0	1.0
3	1.04 (0.84-1.29)	1.12 (0.90-1.38)	1.12 (0.88-1.41)
4th & above	1.65 (1.33-2.05)	1.57 (1.26-1.95)	1.41 (1.10-1.79)
Place of delivery			
Home	1.63 (1.39-1.92)	1.56 (1.31-1.85)	1.30 (1.07-1.57)
Institution	1.0	1.0	1.0
Birth Interval			
≥24 months	1.0	1.0	1.0
<24 months	1.33 (1.14-1.54)	1.25 (1.07-1.47)	1.32 (1.10-1.58)
Birth weight			
Normal	1.0	1.0	1.0
LBW	3.53 (2.90-4.30)	3.61(2.94-4.43)	1.87 (1.49-2.36)
DNK	2.14 (1.78-2.58)	1.97 (1.62-2.40)	1.51 (1.21-1.88)
Time of initiation of BF (hours)			
Within 1 hour	1.0	1.0	1.0
1-24	0.97 (0.82-1.15)	1.10 (0.91-1.32)	0.83 (0.68-1.02)
>24	1.24 (1.01-1.53)	1.39 (1.11-1.74)	1.15 (0.82-1.34)
Pre-lacteal given			
Yes	1.05 (0.90-1.22)	1.13 (0.96-1.33)	0.93 (0.78-1.12)
No	1.0	1.0	
Colostrum given			
Yes	1.0	1.0	1.0
No	1.19 (1.01-1.42)	1.30 (1.08-1.57)	0.98 (0.79-1.21)
Hand washing practices of mother after defecation			
With soap	1.0		
With water	1.74 (1.48-2.05)	1.65 (1.39-1.96)	1.42 (1.18-1.72)
Age at CF (months) (6-11 months children)			
6-8	1.0	1.0	1.0
0-5	1.26 (0.93-1.72)	1.33 (0.97-1.83)	1.01 (0.68-1.48)
≥9/Not started	1.16 (0.94-1.44)	1.24 (0.99-1.55)	0.94 (0.71-1.22)

TABLE 4 ASSOCIATION BETWEEN MATERNAL EDUCATION, OCCUPATION WITH ANC PRACTICES

Particulars	Literacy of mother				Occupation of mother		
	illiterate	1-7 th Class	8 -10 th class	Inter & above	Labour	Housewife	Service+ Business
≥4ANCs	54.0	72.4	80.0	86.6	55.6	71.6	79.7
<3 ANCs	38.7	24.1	19.2	12.6	35.0	25.4	19.0
No ANC	7.3	3.5	0.8	0.8	9.5	3.1	1.3
χ ² , P value	255.8, 0.001				79.3, 0.001		
Registered for ANC (In weeks)							
<12 weeks	63.5	78.8	81.9	84.3	68.3	75.7	93.7
13-36 weeks	29.2	17.7	17.2	14.9	22.2	21.2	5.1
No ANC	7.3	3.5	0.8	0.8	9.5	3.1	1.3
χ ² ,P value	158.6, 0.001				62.9, 0.001		
IFA tablet consumed							
≥90	38.6	46.0	52.9	52.5	37.9	46.8	58.2
0-89	49.1	44.2	37.0	34.3	46.9	42.7	34.2
Not received	12.3	9.9	10.1	13.1	15.2	10.5	7.6
χ ² , P value	56.8, 0.001				22.5, 0.001		
Birth Weight							
>2.5	54.5	67.9	74.9	81.3	52.7	68.3	84.8

<2.5	12.5	15.2	16.4	14.4	13.4	14.8	8.9
DNK	33.0	16.8	8.7	4.3	34.0	16.9	6.3
χ^2 , P value	274.6, 0.001				93.2, 0.001		
Age appropriate feeding							
No	37.9	29.9	28.1	23.5	34.4	31.1	25.3
Yes	62.1	70.1	71.9	76.5	65.6	68.9	74.7
χ^2 , P value	40.4, 0.001				3.50, 0.17		
Birth order							
1 & 2	52.8	71.9	81.1	86.4	54.5	71.4	77.2
3	21.5	17.5	14.3	8.8	21.6	16.5	15.2
4th & above	25.6	10.6	4.6	4.8	23.9	12.1	7.6
χ^2 , P value	324.4, 0.001				69.9, 0.001		
Place of delivery							
Home	36.4	25.7	17.6	9.1	38.1	23.9	16.5
Institutional	63.6	74.3	82.4	90.9	61.9	76.1	83.5
χ^2 , P value	157.7, 0.001				48.0, 0.001		
Interval between last 2 births							
<24	70.0	54.4	47.7	41.4	72.6	54.0	59.5
\geq 24	30.0	45.6	52.3	58.6	27.4	46.0	40.5
χ^2 , P value	154.8, 0.001				59.5, 0.001		
Time of initiation of breast feeding							
<1hr	27.1	31.8	32.4	33.6	35.0	29.9	32.9
1-24 hrs	52.7	48.8	49.8	49.2	49.8	50.4	50.6
>24 hrs	20.1	19.4	17.8	17.2	15.2	19.7	16.5
χ^2 , P value	11.7, 0.06				8.44, 0.07		

TABLE 5 MULTIVARIATE REGRESSION ANALYSIS FOR UNDERNUTRITION WITH ANC, DELIVERY & IYCF PRACTICES FOR <12 MONTHS CHILDREN

Particulars	Underweight		Stunting		Wasting	
	OR	95% CI	OR	95% CI	OR	95% CI
Birth interval						
\geq 24 months	1.0		-	-	1.0	-
<24 months	1.19	1.01-1.40	-	-	1.23	1.03-1.48
Number of ANCs undergone						
\geq 4	1.0		1.0		1.0	
<4	1.50	1.26-1.78	1.45	1.21-1.74	1.33	1.09-1.62
No ANC	1.52	1.05-2.20	1.25	0.83-1.86	1.43	0.94-2.17
Place of delivery						
Home	1.34	1.12-1.62	1.38	1.14-1.68	-	-
Institutional	1.0	-	1.0	-	-	-
Birth weight						
Normal	1.0	-	1.0	-	1.0	-
LBW	3.59	2.94-4.39	3.59	2.92-4.42	1.87	1.48-2.36
DNK	1.52	1.24-1.88	1.42	1.13-1.77	1.28	1.02-1.61
Colostrum feeding						
No	-	-	1.22	1.01-1.48	-	-
Yes	1.0		1.0			
Hand washing practices of mother after defecation						
With soap	1.0		1.0		1.0	
With water	1.46	1.23-1.73	1.44	1.20-1.73	1.26	1.04-1.54
Morbidity during previous fortnight						
Yes	1.42	1.20-1.67	1.34	1.12-1.59	-	-
No	1.0		1.0			

ANC-ante-natal check-up, LBW-low birth weight, DNK-do not know