

# Breastfeeding Practices and Dietary Diversity among Infants and Young Children in Rural and Urban-Slum Populations in India: An Observational Study

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**Abstract:** *Background:* Nutritional exposures and growth in early life are linked to immediate and also to long term health outcomes.

*Objective:* To assess infant and young child feeding (IYCF) practices using WHO-UNICEF defined indicators in rural and urban-slum populations in India.

*Methods:* A community-based, cross-sectional study was conducted in mothers and infants up to age 24 months. Data on socio-demographics, birth history, feeding practices (WHO-UNICEF IYCF indicators), maternal weight, height, and infant's weight, length, mid-arm, and head circumferences were collected.

*Results:* Five hundred and two (252 rural and 250 urban-slum) mother-infant dyads were studied. Proportions of IYCF indicators in rural and urban-slum infants were: Early initiation of breastfeeding 71 and 64%; Exclusive breastfeeding under six months, 59 and 25%; Minimum acceptable diet 11 and 27% respectively. Consumption of animal-source food (other than dairy products) and vitamin-A rich fruits and vegetables was below 15%. Cesarean section [aOR, 95% CI: 2.94 (1.53, 5.65)], hospitalization of newborn [aOR, 95% CI: 6.21 (2.95, 13.16)], pre-lacteal feeding [aOR, 95% CI: 3.38 (1.77, 6.45)], needing help in breastfeeding [aOR, 95% CI: 2.15 (1.04, 4.17)], and male gender [aOR, 95% CI: 2.13 (1.15, 4.25)];  $p < 0.05$  for all] were associated with delayed initiation of breastfeeding, whereas lower monthly household income [aOR, 95% CI: 2.62 (1.10, 6.25)], and younger age [aOR, 95% CI: 1.24 (1.11, 1.38)];  $p < 0.05$  for both] were associated with poor dietary diversity.

*Conclusions:* Education of optimum IYCF practices, targeting early initiation of breastfeeding, increasing meal frequency and intake of vitamin-A rich and animal-source foods need urgent attention.

**Keywords:** Breastfeeding, complementary feeding, India, IYCF practices, predictors.

## INTRODUCTION

Adequate provision of nutrients, beginning in early stages of life, is crucial to ensure good physical and mental development and long-term health. Despite the progress under the Millennium Development Goals, undernutrition and stunting are still the challenges faced by the low and middle-income countries (LMIC) including India [1]. In 2014, 50 million children under age 5 suffered from moderate or severe wasting, and more than two thirds of these lived in Asia [2]. Comparison of child growth patterns in 54 countries, including India, using WHO growth standards has shown growth faltering in weight and length in first two years of life [3].

Infant and young child feeding (IYCF) practices are important determinants of macro- and micronutrient intake in early life. In 2008, the WHO published a set of breastfeeding and complementary feeding indicators

that could be used to assess infant feeding within and across countries [4, 5]. In India, secondary analyses of the National Family Health Survey data, and the Comprehensive Nutrition Survey in Maharashtra showed that IYCF practices are sub-optimal [6-9], and there is a need to study in-depth IYCF practices and its determinants in different locations and socio-economic strata. Mother-child nutrition has also been recently considered as an area of highest concern by the National Steering Group for setting research priorities in nutrition in India [10]. We have undertaken investigations, including determinants of child feeding practices, quantification of breast milk, and study of human milk macronutrient composition. This paper is first in the series, describing findings of IYCF practices from a cross-sectional survey.

## MATERIALS AND METHODS

### Study Design, Setting and Participants

A community based cross sectional study was conducted from April 2013 to March 2014 in rural part

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of Akola district in Maharashtra, and in urban-slum settlement of Bangalore city of Karnataka, in India. The rural population was from the nearest Health Sub-centre from Akola city. Children up to the age of 2 years, from the community centers (Anganwadi) run by the Integrated Child Development Services (ICDS) scheme, were listed and their mothers were invited to participate in the study. In the urban area, a large notified urban slum settlement near the St. John's Research Institute was selected, and children under the age of two years were identified by door to door survey. The rural cohort represented population migrated from surrounding, more remote areas near a town area. The urban cohort was from slum area representing population migrated in a metro city for livelihood. Informed written consent was taken from the mothers. Permission was obtained from the local health authorities. The study was approved by the Ethics Committee of St John's Research Institute, Bangalore.

Based on previous observation of 20% prevalence of exclusive breast feeding in the Bangalore population [11], a sample size of 384 was deemed to be sufficient to observe the prevalence of exclusive breastfeeding, with 20% relative precision and 95% confidence interval. We planned to study 500 children, 400 infants up to 12 months age and 100 children between 12 and 24 months of age from both study sites.

### Data Collection

Data on socio-demography, birth history, and feeding practices were obtained by an interviewer-administered questionnaire that was divided in to five sections: 1. General questionnaire, 2. Standard-of-living questionnaire, 3. Birth history and initiation of breast feeding, 4. Feeding practices and 5. Morbidity in past four weeks of the interview. Feeding practices questionnaire was adapted from the WHO 2010 module of measurement of IYCF indicators [5]. A 24-hour diet recall of the infant was also obtained on three days within a week's period (data not presented in this paper). Birth weight was recorded as recalled by mother and/ or confirmed from the birth records (Nursing Home Discharge Summary or Anganwadi register).

The weight of the mother was measured to the nearest 100g using Tanita 325 Scale (Tanita, Japan), and height to the nearest 0.1cm using CMS weighing equipment (London, U.K). Child's weight was measured on a calibrated electronic scale (Salter, Tonbridge, England) to the nearest 10g, and length,

nearest to 0.1cm using infantometer (Seca, Hammer Steindamm, Hamburg, Germany); head and mid arm circumferences were measured to the nearest 0.1cm using Rollfix non-stretchable tape (Hoechstmass, Germany). The IYCF indicators were determined using the WHO-UNICEF definitions [4, 5]. Early initiation of breastfeeding was based on historic recall by mothers as infants who were put to the breast within 1 h of birth. All other indicators are based on recall of practices from the previous day. For example, exclusive breastfeeding among infants 0–5 months of age and continued breastfeeding at 1 year in 12–15 months old are calculated from recall of exclusive and any breastfeeding, respectively, on the previous day only.

### Statistical Methods

Continuous data is reported as means and standard deviations (sd). Infant feeding practices are expressed as frequencies and percentages. Standard of living index (SLI) was determined as used in the National Family Health Survey of India, as a summary of household measures composed of 27 items, including consumer durables, agricultural machinery, housing conditions and access to water, light, fuel etc. with weightage varying from 0 through 4. The index is calculated by summing the weights with possible scores ranging from 0 to 67 [7].

Child's nutritional status was measured using the WHO international growth standards [13], and z scores were derived from the WHO Anthro software (version 3.2.2, January 2011). Children who were 2 SD below the median for weight-for-height (WHZ), weight-for-age (WAZ) and height-for-age (HAZ) z scores were classified as wasted, underweight and stunted respectively.

Based on the different socio-demographic, mother-child factors associated with IYCF in the literature, we first examined the individual association of factors (potential predictor variables such as SLI, monthly income, parental education, maternal employment before pregnancy, type and place of delivery, low birthweight, birth order and gender of child, maternal BMI, number of children in household, hospitalization after birth, help with breastfeeding initiation, giving pre-lacteal feeds) with IYCF indicators by chi-square tests, using a cut-off of  $P < 0.05$  for each study site. Next, multiple logistic regression analysis was performed to assess the risk factors identified in bivariate analyses. The variables which retained statistical significance in the final model only are presented in the tables. The

findings are presented as odds ratio (adjusted odds ratio, aOR) with 95% confidence intervals (95% CI). Data analysis was done using SPSS (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp).

## RESULTS

Data were collected from 502 mother-child dyads: 250 urban-slum and 252 rural, of which 486 children belonged to age group 0 to 23 months, and were included in the analyses of feeding practices.

## Socio-Demographic and Mother-Child Characteristics

Some of the socio-demographic characteristics, and mother-child body size are described in Table 1. The mean (sd) age of mothers from both sites was 24.6 (3.8) years, and 49% had only one living child. Majority of the study population lived as a joint family, and 75% of the households had one or two children. Four percent of rural and one percent of urban-slum mothers delivered at home, 57 and 79% delivered in government facility, respectively. The proportion of cesarean deliveries was 33% in rural and 20% in

**Table 1: Socio-Demographic and Body Size Characteristics of the Study Population**

Variable	Rural (n=252)	Urban-slum (n=250)
<b>Type of Family, n (%)</b>		
Nuclear	55 (22)	117 (47)
Extended	30 (12)	8 (3)
Joint	167 (66)	125 (50)
<b>Number of living children the mother has, n (%)</b>		
One	123 (49)	121 (48)
Two	103 (41)	84 (34)
Three or more	26 (10)	45 (13)
<b>Total number of children in households, n (%)</b>		
One	92 (36)	104 (42)
Two	96 (38)	89 (36)
Three or more	45 (26)	57 (22)
<b>Mother's Education (years of schooling), n (%)</b>		
No education	7 (3)	22 (9)
1 – 8 y	31 (13)	99 (39)
9 – 13 y	176 (70)	121 (49)
University	38 (15)	8 (3)
<b>Father's Education (years of schooling), n (%)</b>		
No education	7 (3)	35 (14)
1 – 8 y	42 (16)	94 (37)
9 – 13 y	160 (63)	116 (46)
University	43 (17)	5 (2)
<b>Standard of Living score, mean (sd)</b>	<b>29 (9)</b>	<b>25 (6)</b>
Mothers' BMI (kg/m <sup>2</sup> ), mean (sd)	20.9 (3.1)	22.3 (4.1)
Child characteristics, mean (sd)	(n=249)	(n=237)
Age (mo)	6.8 (6.3)	7.8 (6.9)
Male (n, %)	125 (50)	120 (48)
Infants below 6 mo age (n)	155	128
Length for age z score, HAZ	-1.03 (1.4)	-1.0 (1.3)
Weight for age z score, WAZ	-1.43 (1.1)	-1.06 (1.0)
Weight for length z score, WHZ	-1.03 (1.0)	-0.6 (1.4)

urban-slum sample. Twenty-four percent of rural mothers were underweight (BMI < 18.5 kg/m<sup>2</sup>) and 19% of urban-slum mothers were overweight (BMI > 25 kg/m<sup>2</sup>). The mean birth weight of infants was 2.7 (0.5) kg in rural and 2.8 (0.6) kg in urban-slum sample, and 19% were born low birth weight (<2.5 kg). Compared to the WHO Growth Standards, mean anthropometric z scores were below the median, and the proportion of wasting, underweight and stunting was 16%, 29% and 25% in rural and 16%, 19% and 21% in urban-slum children respectively. The median monthly household earning was 7500 rupees in rural and 8000 rupees in urban-slum households.

### Breastfeeding Practices

Indicators of breastfeeding and complementary feeding practices are described in Table 2. Early initiation of breastfeeding was seen in 71% rural and 64% of urban-slum children, but exclusive breastfeeding for first six months was reported in only 59% rural and 25% of urban-slum children. Seventy-seven percent of rural and 46% of urban-slum mothers received advice about starting breastfeeding after delivery; 65% of rural mothers were advised by the doctor, and 50% of urban-slum mothers by the child's grandmother. About 6% of rural and 11% of urban-slum mothers reported having had some difficulty in the

initiating breastfeeding. In the first 3 days of life 37% of the rural and 49% of the urban-slum children received pre-lacteal feeds, and within them 60% were offered it only once or twice. In 46% of those rural infants pre-lacteal feed consisted of milk other than the breast milk, and in urban-slum it was sugar or jaggery water. All, except one urban-slum child, were reported to be 'ever breastfed'. The average frequency of breast feeding in all infants below the age of six months was 7 times during the day and 3 times during the night. Continued breastfeeding at or beyond 12 months was reported by 90% rural and 87% of urban-slum mothers.

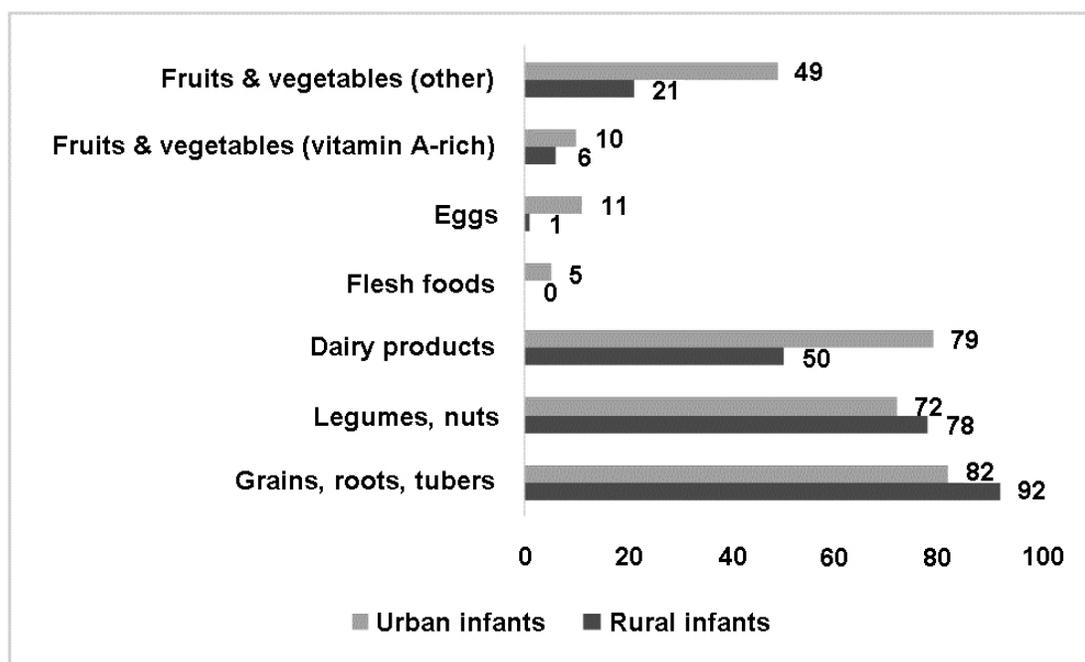
### Complementary Feeding Practices in 6 to 23 Months Old Children

The mean (sd) age of starting complementary feeds was 6.8 (1.9) in rural and 5.5 (2.0) months in urban-slum infants, and in 71% of rural and 79% of urban-slum infants complementary feeding was started in 6 to 8 months of age. Thirteen percent rural and 21% urban-slum children in age group 6 to 23 months were not breastfed in last 24 hours, and the mean (sd) frequency of complementary feeding was 4.3 (1.9) and 2.6 (0.9) times per day, respectively. The mean (sd) age of stopping breastfeeding was 14.8 (4.8) months. About 50% mothers said that they planned to continue breastfeeding till the infant is 24 months old.

**Table 2: Breastfeeding and Complementary Feeding Practices (Proportions) in Children**

Breastfeeding Indicators	Rural	Urban-slum
Ever breastfed	100	99.6
Early initiation of breastfeeding	71	64
Exclusive breastfeeding under 6 mo	59.4	25
Continued breastfeeding at 1 year	90	87
Age-appropriate breastfeeding	63	44.3
Predominant breastfeeding under 6 mo	36	58.6
Bottle-feeding under 6 mo	2.4	10.9
<b>Complementary Feeding Indicators</b>		
Introduction of solid, semi-solid or soft foods	71.4	78.8
Frequency of complementary feeds per day, mean (sd)	4.3 (1.9)	2.6 (0.9)
Food groups score, mean (sd)	3.0 (1.2)	3.3 (1.4)
Minimum meal frequency	90.4	41.8
Minimum dietary diversity	13.8	46.8
Minimum acceptable diet	10.6	26.6

All numbers indicate percentages, unless specified. [Minimum meal frequency: For breastfed children: 6-8 months of age: 2 times/d; 9-23 months of age: 3 times/d; for non-breastfed: 4 times/d. Minimum acceptable diet: Breastfed children (6-23 mo) who had at least the minimum dietary diversity and the minimum meal frequency during the previous day; non-breastfed children who received at least 2 milk feedings and had at least the minimum dietary diversity not including milk feeds, and the minimum meal frequency during the previous day].



**Figure 1:** Consumption of food items from seven food groups in urban-slum and rural children aged 6 to 23 months.

Commercial infant food was used by 20% of rural and 26% of urban-slum mothers.

In rural infants, the mean frequency of consumption of semi-solid or soft food was 4.3 (1.9) per day, frequency of breastfeeding 8 (3.7) times per day, and the mean food group score was 3 (1.2) per day. In urban-slum sample, mean feeding frequency was 2.6 (0.9) per day, food group score was 3.3 (1.4) (Table 2). Figure 1 shows the proportion of food consumed from seven defined food groups in rural and urban-slum children. The frequency of dairy item (79 vs. 50%) and non-vegetarian food (16 vs. 1%) consumption was higher in urban-slum than in rural infants respectively. Seventy percent of rural and 63% urban-slum mothers said they were told about weaning, by a relative or a health worker. Rural mothers said that they usually get advice about what the child should be fed, from a local doctor (30%) or from a community health worker (26%) or mother-in-law (17%), and 20% utilize their own experience from previous child; urban-slum mothers decided on their own (37%) or were advised by mother-in-law (24%), neighbor (15%) or doctor (11%). Overall, the rural children had poor dietary diversity (14%) and acceptable diet was seen in only 11% children. Thirty-seven percent of the rural infants and 50% of the urban-slum infants were taken to a local doctor for some or the other illness in previous four weeks of interview; in majority the reason was acute respiratory illnesses.

#### Associations of Socio-Demographic, Mother-Child Factors and Feeding Practices

Breastfeeding (exclusive or predominant) under six months was seen in about 85% of the study infants. There was no association of exclusive breastfeeding under six months with any of the demographic variables measured, including family type, SLI, parental education, place and mode of delivery, birth order or with child's anthropometric z scores (data not shown).

In rural children, failure of early initiation of breastfeeding was associated directly with cesarean delivery, mothers who required help in initiating breastfeeding, offering pre-lacteal feeds, male offspring, and hospitalization of offspring to neonatal care unit, and in urban-slum sample, with delivery in private nursing home. After adjusting for various socio-demographic and maternal-infant factors, failure to initiate breastfeeding within an hour of delivery was almost three times more common in caesarean delivery in both rural and urban-slum sample; thrice in rural children who received pre-lacteal feeds, twice in males and in those where the mother required help in initiating breastfeeding (Table 3). Rural children who required hospitalization in perinatal period were at the highest risk of delayed initiation of breastfeeding.

In both rural and urban-slum children, food group score was directly associated with child's age ( $r=0.26$ ,  $P=0.011$  and  $r=0.56$ ,  $P<0.001$ ) and frequency of feeds

**Table 3: Characteristics Associated with Failure of Early Initiation of Breastfeeding in Rural and Urban-Slum Infants and Young Children**

Characteristics	Rural sample	Urban-slum sample
	aOR (95% CI)	aOR (95% CI)
Delivery by caesarean section	2.94 (1.53, 5.65)***	2.65 (1.38, 5.10)**
Hospitalisation in neonatal period	6.21 (2.95, 13.16)***	-
Pre-lacteal feeds given	3.38 (1.77, 6.45)***	-
Received help in breastfeeding in nursing home	2.15 (1.04, 4.17)*	-
Offspring gender, Male	2.13 (1.15, 4.25)*	-

aOR, adjusted odds ratio (Adjusted for all variables statistically significant in the bivariate analysis). \* $P < 0.05$ , \*\* $P < 0.01$ , \*\*\* $P < 0.001$ .

per day ( $r=0.51$ ,  $P<0.001$  and  $r=0.27$ ,  $P=0.005$ , respectively). In rural sample, risk of poor dietary diversity (food groups  $<4$ ) was four times more in children of mothers with formal education less than 9 years, compared to those whose mothers had education 9 or more years [OR, 95% CI: 4.27 (1.21, 15.06),  $P=0.03$ ]; and was eight times more in households in lowest tertile of income [OR, 95% CI: 7.79 (1.50, 40.37),  $P=0.012$ ] than in the highest income tertile. In adjusted analysis, only monthly household income was associated with dietary diversity [aOR, 95% CI: 2.62 (1.10, 6.25),  $P=0.030$ ]. In urban-slum sample, dietary diversity was positively associated with child's age, and no breastfeeding in last 24h; and adjusted analysis showed that older children were more likely to get more diverse diet than younger infants [aOR, 95% CI: 1.24 (1.11, 1.38),  $P<0.001$ ].

## DISCUSSION

In this survey we have studied child feeding practices in rural and urban-slum populations, in two states of India using similar methodology. Comparative evaluation of IYCF practices in Indian children, using WHO-UNICEF indicator definitions, from large data

sets is shown in Table 4 [7, 12, 14]. Breastfeeding indicators show an improving trend of early initiation and exclusive breastfeeding practices, but the gain is not very appreciable. Similar observation is noted in the comparative analyses of exclusive breastfeeding practices in India's national data of year 1992-93 and 2005-06, which was carried out to guide policy makers in the development of targeted breastfeeding promotion strategies [15].

The predictors of delayed initiation of breastfeeding viz. delivery by caesarean section, hospitalization of neonate, giving pre-lacteal feeds, mothers who require support in breastfeeding, and male gender are consistent with those observed in other reports [16, 17]. The proportion of institutional deliveries in India is rising, and rates of caesarean section are doubled, from 8.5% in NFHS-3 to 17.2% in NFHS-4 [7]. This underpins the need to enhance facility-based IYCF training to the healthcare staff. Male infants were less likely to receive early breastfeeding, which is also described in the African and Latin American sites of the multi-country IYCF study, the reason of which is not clear and speculated to be cultural [16]. We did not find gender preference in any other feeding practices.

**Table 4: Prevalence of Infant and Young Child Feeding Indicators Published in Selected Studies from India.**

Indicators of infant feeding	Present Study		NFHS-3 (2005-06) [12]	Mumbai Study (2013) [14]	NFHS-4 (2015-16) [7]
	Rural	Urban-slum			
Early initiation of breastfeeding	71	64	23.4	46	41.6
Exclusive breastfeeding under 6 mo	59.4	25	46.4	62.6	54.9
Continued breastfeeding at 1 y	90	87	85	73.5	na
Introduction of semi-solid or soft foods	71.4	78.8	64	41.2	42.7
Minimum meal frequency	90.4	41.8	45	43.3	na
Minimum dietary diversity	13.8	46.8	16	13	na
Minimum acceptable diet	10.6	26.6	9	4.7	9.6

na= data not available.

Traditional practice of offering pre-lacteal feeds like honey, sugar or jaggery water, still widely prevalent, needs to be discouraged. Low rates of 'exclusive' breastfeeding under six months, but high proportion of 'ever breastfed' infants (99%) and continued breastfeeding at one year (88%) in our study indicate that breastfeeding is a cultural norm in this population, but 'exclusivity' of breastfeeding under the age of six months needs to be targeted. Recent review and meta-analyses have shown that delayed initiation of breastfeeding ( $\geq 24$  hours after birth) had an 85% (95% CI: 29-167%) greater risk of neonatal mortality compared to infants in whom it is initiated early ( $< 24$  hours after birth) [17]. It is estimated that scaling up of breastfeeding can prevent 823,000 child deaths every year all over, and might contribute to achievement of the Sustainable Development Goals [18]. In terms of morbidity reduction, about half of all diarrhoea episodes, a third of respiratory infections and 68% of malocclusions would be avoided by breastfeeding [18].

The proportion of children who received 'age appropriate breastfeeding' was low in our study, as this indicator is composite of proportion of exclusive breastfeeding and introduction of semi-solid food. Delayed introduction of semi-solid food, and persistent breastfeeding when breast milk may not fulfil the energy requirements of a growing infant may lead to undernutrition and micronutrient deficiencies.

Complementary feeding practices observed in our study and in other larger data sets need serious attention. Regional data of NFHS-4, from same places where we conducted our survey, show that only 16.1% of children in Bangalore (urban) region and none (0%) from rural Akola received an adequate diet [7]. Dietary patterns established in early life are strongly influenced by socio-demographic and maternal factors and remain so over initial years. A recent longitudinal study of dietary pattern trajectories of infants in multi-ethnic Asian cohort reported that Indian mothers had a higher start scores on easy-to-prepare foods but greater adherence to 'predominant' breastmilk with time [19]. The analyses of national survey data of five South Asian countries – Bangladesh, India, Nepal, Pakistan and Sri Lanka, showed that poverty, low level of maternal education, lower frequency of antenatal visits and no exposure to media were the factors associated with inappropriate feeding practices [20]. Positive associations of food group score with infant's age and with frequency of meals in our survey indicate that efforts to educate the mother and other family

members about these may help to increase dietary diversity and consequently micronutrient intake.

Our study has certain limitations. The sample size calculation did not take into account IYCF indicators other than prevalence of exclusive breastfeeding. We chose a convenient sample, and no special sampling technique was used, as we wanted to carry out a longitudinal study of quantification of breastmilk in the same sample. We did not measure water, sanitation and hygiene (WASH) practices, which are also shown to be important determinants of child health and nutrition in India [21].

The findings of poor rates of some of the IYCF indicators and relatively better rates of other in our study could be explained by a mix of socio-cultural practices such as universal and prolonged breastfeeding on one hand, and offering ritual fluids in addition to breast milk on the other. Inequalities in child health, including breastfeeding practices within population groups (rural vs. urban), and between Indian states are well described, and are ascribed to lack of universal health education and healthcare access [22].

In conclusion, our study highlights need of interventions that seek to increase proportion of early initiation of breastfeeding or feeding own mother's milk, in situations such as cesarean delivery, and in high risk newborns, and to discourage pre-lacteal feeding. Similarly, effective interventions should be designed to increase dietary diversity in children beyond age of six months, as this age is considered as a nutritionally turbulent time for an infant that may influence later health and development [23]. This would help to address child undernutrition in India.

## CONCLUSION

Our study highlights suboptimal rates of exclusive breastfeeding under 6 months, and largely inadequate complementary feeding after 6 months of age. Interventions that seek to increase early initiation of breastfeeding should be focused more on situations such as operative delivery and high risk newborns who need special care support. Recent focus on potential pathways and mechanisms through which infant feeding may influence non-communicable disease risk in later life, suggest a need to investigate in detail nutrients provided from human milk and from homemade complementary foods. This will also help to design interventions to prevent undernutrition in under-5 children in India. The WHO indicators are valuable

tools for broadly assessing the quality of infant diets and for monitoring population trends in IYCF practices over time.

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## CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

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