Original article

Complementary feeding practices of tribal mothers to their Infants and Young Children in Kerala

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ABSTRACT

Problem: As WHO recommends, timely and optimal introduction of complementary feeding (CF) at 6th month as it complements additional energy and growth needs of young children. We know relatively little about CF practices of tribal mothers in the context of high rate of poor health and under nutrition in tribal children of Kerala. This study therefore examined the factors influencing CF practices to tribal infants and young children. **Methods:** We conducted a community based cross-sectional survey of 1150 tribal mother-infant pairs from five districts. We used pre-tested interview schedule for data collection. Alongside descriptive statistics, we used multiple linear regression for data analyses.

Results: Around 76.2% continued BF at 6th month, 62.7% introduced CF at 6th month, 22.7% children received low or potentially harmful CF, 48.4% children received harmful CF and merely 8.6% received optimal CF. The maternal education, marital status, age at first pregnancy optimized CF and occupational status, hours of work per day, work status before pregnancy and age at marriage were inversely associated with 40% of variance ($R^2 = 0.40$). Tribal mothers' breastfeeding duration and frequency of child bathing significantly increased optimal CF and children' age at CF initiation. The poor breastfeeding at public place inversely associated with 44.7% variance ($R^2 = 0.447$). Tribal mothers' perceived difficulty for breastfeeding at public space increased CF scores and mothers who early initiated CF were more likely to feed children less-optimal ($R^2 = 0.365$).

Conclusion: Tribal mothers practice predominantly poor and potentially harmful CF to young children aged 6–24 months.

1. Introduction

Tribals of Kerala are heterogeneous social category demographically, culturally, socially, linguistically and on key health indicators.^{1–3} Therefore, there are considerable variations in current state of development characterised by a sharp human development divide between tribal and non-tribal communities.⁴ Tribal children are susceptible for developing malnutrition due to systematic vulnerabilities such as poverty, illiteracy, increased parental substance abuse and poor health that varying influence household capacities to afford adequate and appropriate dietary intake.⁵ There are evident diversity across different tribal communities on initiation of complementary feeding (here after CF), its frequency, quality and associated hygiene practices. Hence, developing state level data-base on infant feeding practices among tribal

communities was critical to improve current knowledge and to strategize existing CF practices (see Table 1, Fig. 1).

Situating within these structural vulnerabilities in general, optimal CF practices were critical to prevent malnutrition in children. Hence, examining the existing breastfeeding and CF practices, for their adequacy and appropriateness, were critical to develop context specific knowledge to address malnutrition in tribal children in later life. Relatively less amount of systematic studies were available on CF practices in Kerala in comparison to the eastern and central Indian tribes (e.g., Refs. 6–18).

Given these diverse and varying standards of CF practices across different tribal groups; relatively less systematic knowledge base addressing unique socio-cultural practices associated with CF practices in tribal communities; importance of optimal CF practices as per WHO

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Table 1

Shows the sample size and selection procedures.

Districts covered	Blocks covered	Village panchayats covered	Tribal Hamlets Covered	Mothers interviewed
Kassargod	3	5	58	150
Kannur	4	9	90	150
Wayanad	3	9	94	300
Palakkad	1	3	81	250
Idukki	3	12	98	300
Total	14	38	421	1150

standard protocol^{19,20}; locating within background of high level of malnutrition in tribal children¹²; lack of systematically produced knowledge base on barriers to timely CF initiation, indeed justify the need for this study to examine the existing CF practices of tribal communities.

2. Materials and method

This population based cross-sectional survey was conducted after receiving approval from the Institutional Review Board of Dharmagiri Jeevas Social Centre, a DSIR certified voluntary organization working in the areas of social marginality and health in Kerala, located at Cherupuzha of Kannur district in Kerala (DJSC/IRB/M002-2017; dated: 18-03-2017). We obtained a written permission from Kerala State Tribal Directorate to access tribal habitats in selected districts. This study was based on the data from the survey phase of a 3 year ICMR Adhoc Research Project (2017–20) in Kerala.

The study universe constituted all breastfeeding tribal mothers in Kerala whereas the study sample was defined as: 'breast feeding tribal mother-infant pairs in five selected districts, whose infants were aged between 0 and 24 months of old at the time of interview.' We considered 0–24 months age range due to its critical role for optimal infant and young child feeding for optimal child growth, survival and health that sustain beyond.¹⁹ As evident in the sample definition, we included a household to study, if a mother is of a tribal origin, belong to any of five selected districts viz., Kassargod, Kannur, Wayanad, Idukki and Palakkad with an infant or young child aged between 0 and 24 months of age.

2.1. Sample size and selection procedure

Using OpenEpi (<http://www.openepi.com/SampleSize/SSCC.htm>) of the Centre for Disease Control, we estimated the sample size for this cross-sectional survey. Tribal women's population size (as per²¹ was (N) 534202 and hypothesized percent of outcome factor in the population was (p) 75% $\pm$ 5. Confidence limits was 5% with a design effect of 1 with a confidence level of 99.9% we obtained a sample size of 1134. Thus the calculated sample size is 1134, which is rounded up to into 1150.

The sample selection procedure involved multiple stages. Firstly, out of 14 districts of the state, we selected 5 districts namely Kassargod, Kannur, Wayanad, Palakkad and Idukki since they have sizable tribal population approximately ranging from 1% to 17% of its district population, which accounted for about 76% of the state tribal population. Secondly, we identified 38 village panchayats from 14 development blocks of five districts with sizable tribal population by using District Panchayat Level Statistics (Dept. of Economics and Statistics, Govt. of

Fig. 1. Shows the sample-selected districts that details the selected blocks and panchayats

Please click the following link for more details of sample selection procedure <https://www.google.com/maps/@11.1162184,73.8155473,7z/data=!3m1!4b1!4m3!11m2!2s1M0noXbfEUF6Hls5LadQCKLqWqmCoQ!3e3.ta=!3m1!4b1!4m3!11m2!2s1M0noXbfEUF6Hls5LadQCKLqWqmCoQ!3e3> \o "https://www.google.com/maps/@11.1162184,73.8155473,7z/data=!3m1!4b1!4m3!11m2!2s1M0noXbfEUF6Hls5LadQCKLqWqmCoQ!3e3"

Kerala). In so selected village panchayats, our research team directly approached village panchayats to obtain list of 764 tribal hamlets, out of which this survey has covered 421 tribal hamlets (locally known as either colony or 'Uoors') through random selection of hamlets. Thirdly at each selected tribal hamlet, we developed a detailed list of breastfeeding tribal mothers with the help of counsellors, ICDS centres and ASHA. And this list of breastfeeding were used as primary sampling units (PSUs) from which final study units were drawn. Nearly 50–60% of the enlisted breastfeeding mothers were approached for informed consent and subsequent participation in structured interviews. The trained interviewers have contacted every alternate household by using systematic sampling to select final study unit (i.e., tribal feeding mothers) adhering to the prior set inclusion criteria and subsequent interviews.

2.2. Ethical issues approval

The research proposal was submitted for approval from the Institutional Review Board dually constituted for the purpose, of the Dhar-magiri Jeevas Social Centre as per the Guidelines of Indian Council of Medical Research (ICMR New Delhi). Written consent was obtained from tribal mothers after explaining a brief on the purpose, nature and benefits of participation in the surveys. All participants were informed that personally identifying information such as name shall be confided. Confidentiality was ensured during the entire study tenure such as data collection and data analysis.

3. Measures

We used an interviewer-administered-questionnaire that consisted of socio-demographic profiles of mothers, fathers and young children. The mothers' profile contained age, education, occupation, marital status, age at marriage, age at first pregnancy, working hours and earning per day. The child profile contained age in months, gender, birth weight, and birth order. The fathers' profile contained age, education, occupation and earning per day.

A 9-item Standard of Living Index²² was used to examine the living standard of tribal mothers. Items were type of house, toilet facility, source of lighting, main fuel for cooking, source of drinking water, separate room for cooking, own agricultural land, livestock and ownership of durable goods.

We used a modified 16-item Complementary Feeding Index (CFI), which was originally developed by²³ to measure frequency, adequacy and appropriateness of CF alongside initiation time and continued breastfeeding. With the addition of two items, the modified CFI taped continued BF at 6th month, bottle feeding, timely CF initiation, dietary diversity for the past 24 h, food frequency for the past 7 days, meal frequency over the past 24 h across different age groups of 6–8 months, 9–11 months and 12–24 months. The original scale contained 14 items with a minimum score of 3 to maximum of 23 but the modified CFI had a minimum of 3 to maximum of 31 scores. These were divided into three equal groups or each group contains one third of the scores with order of low to high. Hence, the scores were divided from 3 to 12.3 as potentially low/harmful CF practices (0); from 12.4 to 21.6 as medium/harmful practice (1), and from 21.7 to 31 high or positive CF practice (2).

We used additional questions to elicit information on mothers' breastfeeding duration, frequency of bathing to child, reasons for early CF and perceived BF benefits to children and mothers, diverse BF breastfeeding practices.

4. Analysis

For descriptive analysis, we used frequency, percentile, mean and standard deviations. For multiple linear regression analysis, we grouped socio-demographic characteristics into three viz., breastfeeding mothers, children and fathers. And then, we tested the plausible role of multi-collinearity using tolerance and variance inflation factor (VIF).

The multicollinearity exist when tolerance is below 0.1 and VIF is greater than 10. In tested models, tolerance level were within the acceptable limits (i.e., less than 0.1) and VIF less than 10.

5. Results

Table 2 summarizes the socio-demographic characteristics of tribal mothers. The mothers' mean age was 26.5 (SD = 4.9) years where 47.1% aged between 19 and 25 years and 46.6% aged between 26 and 36 years. The mean years of education was 8.1 (SD = 4.3) years where 34.3% were high schooled and 18.2% were not formally schooled. Nearly 97.5% were married and 82.2% were housewives. Among working mothers, mean working hours was 1.6 (SD = 3) hours, 2.2 (SD = 2.8) days per week, and mean earning per day was 107.9 (SD = 156).

Nearly 41.4% of the mothers were working before pregnancy. The mothers' mean age at marriage was 22.1 (SD = 3.4) years and 30.7% reported early marriage between 13 and 18 years of age, although 61.6% were married during their age between 19 and 25 years. Nearly 7% of tribal mothers had early pregnancy before the age of 18 years and 77.2% had pregnancy during the age between 19 and 25 years.

Table 3 summarizes socio-demographic characteristics of young children and their fathers. The mean age of young children was 11.7 (SD = 7.1) months where 28.7% were aged between 0 and 6 months and 71.3% were aged between 7 and 24 months. In children's gender, 51.5% were males and 48.5% were females. In birth intervals, 43.8% were first children, 6.5% reported elder children were aged less than 24 months, 20.3% reported elder child belong to the age group of 25–48 months, and 29.4% reported elder one to the indexed children were aged 48 months and above.

In fathers' profile, the mean age was 31 (SD = 5.8) years and mean years spent for formal schooling was 7.2 (SD = 4.1) years. In occupation, 70.8% were manual labourers and 6.9% were farmers and mean earning per day was 509.9 (SD = 162).

As **Table 4** shows, out of 1150 tribal mothers, 76.2% mothers continued breastfeeding at 6th month where only 62.7% of mothers introduced CF at 6th month. Interestingly, 3.6% (n = 160) did not introduce CF at 6th month and nearly 23.1% were currently on bottle feeding. Young children's age at CF initiation range from 0 to 12 months with a mean of 4.5 (SD = 2.8) months. In Complementary Feeding Index, we obtained the scores range from 3 to 31 with a mean of 13.8 and SD 5.9. This distribution of scores were divided into *terciles* resulting three categories viz., low (potentially harmful), medium (harmful) and high

Table-2
Socio-demographic characteristics of tribal feeding mothers.

Mothers' profile characteristics	Mean (SD) Frequency (n)	Mothers' profile characteristics	Mean (SD) Frequency (n)
Age in yrs.	26.5 (4.9)	Age at marriage	22.1 (3.4)
13–18 yrs.	09 (0.8)	13–18 yrs.	353 (30.7)
19–25 yrs.	542 (47.1)	19–25 yrs.	708 (61.6)
26–35 yrs.	536 (46.6)	26–35 yrs.	87 (7.6)
36–45 yrs.	63 (5.5)	36–45 yrs.	0.2 (0.2)
Education in yrs.	8.1 (4.3)	Age at first pregnancy	22.1 (3.4)
No formal schooling	136 (18.2)	13–18 yrs.	81 (7)
LP school	129 (11.2)	19–25 yrs.	888 (77.2)
UP School	196 (17)	26–35 yrs.	177 (15.4)
High school	394 (34.3)	36–45 yrs.	04 (0.3)
HSS	192 (16.7)	–	–
UG & above	103 (9.0)	–	–
Marital status		Working hrs. per day	1.6 (3.0)
Married	1121 (97.5)	Working days per week	2.2 (2.8)
Widowed/separated	29 (2.5)	Earning per days	107.9 (156)
Occupation		Work status before delivery	
Homemakers	945 (82.2)	Yes	
Manual labour	128 (11.1)	No	476 (41.4)
Agriculture	23 (2.0)		674 (58.6)
Formal sector jobs	54 (4.7)		

Table-3

socio-demographic characteristics of infants and young children and their fathers.

Children's profile characteristics	Mean (SD) Frequency (n)	Fathers' profile characteristics	Mean (SD) Frequency (n)
Age in months	11.7 (7.1)	Age in years	31.0 (5.8) yrs.
0–6 months	330 (28.7)	–	–
7–24 months	820 (71.3)	–	–
Birth weight M(SD)	2.5 (.54)	Years of schooling	7.2 (4.1) yrs.
Gender (Male)	592 (51.5)	Earning per day	509.9 (162)
Female	558 (48.5)	–	–
Birth interval		Fathers' occupation	
First child	504 (43.8)	Not working	13 (1.1)
Less than 24 months	75 (6.5)	Manual labourer	814 (70.8)
25–47 months	233 (20.3)	Farmers	79 (6.9)
48 & more months	338 (29.4)	Other form of works	244 (21.2)

(positive) CF practices. The frequency distributions showed 22.7% were low CF which was potentially harmful to young children, 48.4% had received suboptimal or harmful CF practices and 8.6% received optimal or adequate CF.

Effect of Parental and child characteristics on CF scores: In the first model, we examined the effect of parental and child characteristics on CF scores to tribal children (Table 5). F statistic showed an overall model, significant at 0.001 level ($F(916) = 33.251$; $p < .001$). The maternal education ($\beta = 0.144$; $p < .001$), marital status ($\beta = 0.061$; $p < .05$) and age at first pregnancy ($\beta = 0.108$; $p < .05$) significantly improved CF scores. But the occupation ($\beta = -0.163$; $p < .001$) and daily working hours ($\beta = -0.106$; $p < .05$), work status before pregnancy ($\beta = -0.102$; $p < .05$) and age at marriage ($\beta = -0.118$; $p < .05$) significantly reduced CF scores. In children's profile, age significantly influenced ($\beta = 0.574$; $p < .001$) and in fathers' profile, schooling significantly improved CF ($\beta = 0.091$; $p < .01$) suggesting better paternal education improve CF practices. The overall model accounted for 40% of variance on CF practice of tribal mothers. Therefore, the results suggest that good

parental schooling, being married and high age at first pregnancy significantly improved CF scores but maternal occupation, daily working hours, work status prior to pregnancy and lower age at marriage significantly reduced CF scores. Advancing age was associated with increased CF scores.

Effect of breastfeeding practices on CF scores: In second model (see Table 5), we examined the effect of breastfeeding related factors on optimal CF after controlling for parental and child characteristics. F statistic suggests that overall model was significant ($F(916) = 30.097$; $p < .001$). The BF duration ($\beta = 0.138$; $p < .001$) and frequency of bathing to child ($\beta = 0.058$; $p < .05$) significantly increased optimal CF scores but children's age at CF initiation ($\beta = -0.110$; $p < .001$) and negative BF at public space ($\beta = -0.080$; $p < .01$) significantly reduced optimal CF scores. The parental and child characteristics held constant for analysis showing significant associations were education ($\beta = 0.13$; $p < .001$), marital status ($\beta = 0.062$; $p < .05$), occupational status ($\beta = -0.123$; $p < .001$), age at marriage ($\beta = -0.106$; $p < .05$) and children's age ($\beta = 0.528$; $p < .001$). This model accounts for nearly 44.7% of variance on CF scores ($R^2 = 0.447$). The results suggest that the tribal mothers' breastfeeding duration, frequency of bathing child significantly optimized CF scores. Further, negative breastfeeding at public space significantly reduced CF scores. The mothers considering BF at public space as difficult has an improved scores on CF. Nonetheless, feeding mothers who initiated early CF tend to feed their children less optimal.

Effect of breastfeeding practices on age at CF initiation: In third model (see table- 5), we examined the breastfeeding factors influencing age at CF initiation. F statistic shows a significant model ($F(1149) = 140.017$; $p < .001$). None of the maternal characteristic significantly influenced children's age at CF initiation. Instead, children's present age significantly associated with age at CF initiation ($\beta = 0.544$; $p < .001$), alongside mothers' plan for long duration of breastfeeding increased age at CF initiation ($\beta = 0.057$; $p < .05$). The general household standard of living ($\beta = 0.095$; $p < .05$) and mothers positive feeding at public space significantly increased age at CF initiation. The overall model accounted for 36.5% variance on age at CF initiation ($R^2 = 0.365$). Hence, the results suggest that children's age, plan for long duration of

Table-4

Frequency and percentage distribution of item wise CF scores (CFI).

Introduction of fluid, semi-solid and solid foods			Frequency (%)	CFI scores categorized			Frequency (%)
Is your child on breastfeed after 6 months				Low: Potentially harmful CF			261 (22.7)
Yes			876 (76.2)	Medium: harmful CF			557 (48.4)
No			41 (3.6)	High: Positive CF			99 (8.6)
Less than 6 months			233 (20.3)	Infants less than 6 months			233 (20.3)
Did you introduce CF at 6th month?				CFI descriptive scores			Mean (SD)
Yes			721 (62.7)	Min-Max			0–31
No			160 (3.6)	Mean (SD)			13.8 (5.9)
Less than 6 months			269 (23.4)	–			–
Is your child currently on bottle feed?				Age at CF initiation			
Yes			266 (23.1)	Min-Max			0–12
No			884 (76.9)	Mean (SD)			4.5 (2.8)
CF	6–8 months	Frequency (%)		9–11 months	Frequency (%)	12–24 months	Frequency (%)
MDD	0/No times	160 (13.9)		0/No times	79 (6.9)	0/No times	57 (5.0)
	1–2 times	453 (39.4)		1–2 times	505 (43.9)	1–2 times	386 (33.6)
	3 or more times	162 (14.1)		4/more times	77 (6.7)	4/more times	151 (13.1)
	Not applicable	375 (32.6)		Not applicable	489 (42.5)	Not applicable	556 (48.3)
MMF (Over last 24 h)	0/No times	87 (7.6)		0/No times	42 (3.7)	0/No times	32 (2.8)
	1–3 times	160 (13.9)		1–3 times	272 (23.7)	1–3 times	280 (24.3)
	2 times/more	496 (43.1)		2 times/more	327 (28.4)	2 times/more	284 (24.7)
	Not applicable	407 (35.4)		Not applicable	509 (44.3)	Not applicable	554 (48.2)
MDD over the past 7 days	Staples food: grains & tubers			Pluses		Animal milks	
	0/No times	268 (23.3)		0/No times	181 (15.7)	0/No times	586 (51.0)
	1–3 times	496 (43.1)		1–3 times	553 (48.1)	1–3 times	175 (15.2)
	4 times/more	76 (6.6)		4 times/more	110 (9.6)	4 times/more	67 (5.8)
MDD over the past 7 days	Not applicable	310 (27.0)		Not applicable	306 (26.6)	Not applicable	322 (28.0)
	Meats and eggs			Vitamin A-rich fruits & vegetables		Other fruits & vegetables	
	0/No times	407 (35.4)		0/No times	315 (27.4)	0/No times	265 (23.0)
	1–3 times	398 (34.6)		1–3 times	465 (40.4)	1–3 times	496 (43.1)
	4 times/more	37 (3.2)		4 times/more	67 (5.8)	4 times/more	85 (7.4)
	Not applicable	308 (26.8)		Not applicable	303 (26.3)	Not applicable	304 (26.4)

Table 5

Shows factors determining complementary feeding to young children.

Predictor variables	Complementary feeding	Complementary feeding	Age at CF initiation
(Constant)	β	β	B
Mothers' characteristics			
Age	.035	.017	.026
Education	.144***	.139***	-.002
Marital status (widowed, never married = 0)	.061*	.062*	-.014
Occupation (homemakers = 0)	-.163***	-.123***	-.033
Daily working hours	-.106*	-.069	-.050
Work before pregnancy (no = 0)	-.102	-.094	-.014
Weekly working days	.092	.049	.067
Daily earning	.003	.012	-.008
Age at marriage	-.118*	-.106*	-.023
Age at first pregnancy	.108	.097	.007
Children's characteristics			
Age (in completed months)	.574***	.528***	.544***
Sex (female = 0)	.032	.023	.035
Birth weight	-.011	—	—
Type of child birth (surgical = 0)	.009	—	—
Fathers' characteristics			
Fathers' age	.026	.030	.010
Education	.091**	.053	.004
Occupation (not-working = 0)	-.004	—	—
Daily earning	-.010	.014	-.040
Test variables			
Breastfeeding duration	—	.138***	.057*
Frequency of bathing child	—	.058*	-.011
Standard of living	—	.037	.095***
Early complementary feeding	—	-.110***	-.034
Perceived BF benefits to child	—	.002	-.015
Perceived BF benefits to mother	—	.004	-.039
Poor breastfeeding	—	-.053	.009
Negative BF at public space	—	-.080**	.002
Positive BF at public space	—	.068	-.063*
F (916)	33.251***	30.097***	140.017***
R ²	0.40	0.447	0.365

Dependent variable: complementary feeding score. * $p < .05$; ** $p < .01$; *** $p < .001$.

breastfeeding, standard of living and positive breastfeeding at public spaces significantly delayed the age at CF initiation.

6. Discussion

Out of 1150 tribal mother-infant pairs from five districts in the state, 76.2% continued BF at 6th month and 62.7% introduced CF at 6th month. Interestingly, 3.6% did not introduce CF at 6th month and 23.1% were currently on bottle feeding. The mean age for CF initiation was 4.5 (SD = 2.8) months. Nearly 22.7% were low/potentially harmful CF, 48.4% received harmful CF while only 8.6% received optimal CF among tribal children. The mothers' schooling, being married, higher age at first pregnancy, children's age and fathers' education have significantly improved CF. But being working, more daily working hours and work status before pregnancy significantly reduced CF scores. Also, mothers who considered BF at public space as difficult to practice had high scores on CF. Nonetheless, feeding mothers who initiated early CF tend to feed their children less optimal. Further, children's age, long duration of breastfeeding, better standard of living and optimal breastfeeding at

public space significantly postponed the age at CF initiation.

Breastfeeding is a universal and prolonged in tribal communities in the state as elsewhere.^{9,24–27} We found nearly 76% of the tribal mothers continued to breastfeed their young children at 6th months where only 3.6% weaned out at 6th month.

¹⁹ WHO recommends CF initiation at 6th month that subsequently improve sizably during 8–12 months. Nonetheless, studies among tribal mother-infant pairs from different parts of India evidenced highly inconsistent and conflicting complementary feeding practices, which were grossly inadequate and suboptimal to infants growth and survival.^{6–8,28,29} Largely, these inconsistencies in CF practices were observed in terms of early and delayed CF, which range from 3 to 6 months and 6 months to even 1 year. Invariably, out of randomly selected 1150 tribal mother-infant pairs from five districts, 62.7% tribal mothers introduced CF at 6th month; whereas the mean CF initiation age was 4.5 months with a SD of 2.8 months. At state level, NFHS-4 (2015–16) estimates 63.1% children aged received CF between 6 and 8 months.

However, NFHS-4 (2015–16) estimates the breastfeeding children receiving adequate diet during age between 6 and 23 months were 23.1% in the state. In this study estimated nearly 22.7% children aged between 6 and 24 months received low or highly harmful amount of CF and 48.4% received harmful CF; while only 8.6% received optimal CF among tribal children. Results evidently suggest the need to develop tribal population based intervention to strengthen optimal CF practices to tribal children during 6–23 months.

Tribal mothers' education, being married, higher age at first pregnancy, children's age and fathers' better education have significantly optimized CF. But being working, more daily working hours and work status before pregnancy significantly reduced optimal CF to young children.

Tribal mothers' education, marital status and age at pregnancy were significantly associated with children's age at CF initiation. Invariably, Sisay, Edris and Tariku³⁰ found maternal education and marital status predicted optimal CF practice alongside other factors such as maternal occupation, household wealth status, post-natal care and health extension visits. However, hours spent for working outside homes, number of working days per week contributed significantly to poor and suboptimal CF practices in tribal mothers.

As evidenced in the studies from other parts of India (e.g., Refs. 31–33, we found that the mothers' years for schooling, being married, higher age at first pregnancy, children's age and fathers' better education significantly optimized CF. But being working, more working hours per day and work status before pregnancy have significantly reduced optimal CF to young children. Results suggested that poor socio-economic conditions of tribal women lead them to work more hours per day and more number of days per week while leading children at homes with other family members. As a result, tribal mothers needs educative interventions alongside support services during the entire child bearing and breastfeeding tenures, through incentives for lost working days and incentives for mothers under existing maternal and child welfare schemes at state and national level.

The maternal proactive breastfeeding associate with quality of CF received by their children at 6th month.³⁴ The mothers who practice optimal breastfeeding such as timely breastfeeding initiation, exclusive breastfeeding for first six months with frequency of 8–12 times a day tend to initiate timely CF to their children. In contrary to these, we found mothers who initiated early CF tends to feed children less optimal. In addition, we found tribal mothers, who considered BF at public space as more difficult to practice had high scores on CF. It is because; such mothers tend to initiate early CF to complement the breastfeeding related difficulties in public spaces.

Moreover, our results suggested that children's age, long duration of breastfeeding, standard of living and optimal breastfeeding at public spaces significantly postponed the age at CF initiation. Invariably, less optimal CF practices results from poor social and economic conditions of

the households, ignorance, poor family wealth status, and access related barriers to prenatal health education.^{6,7,28}

The study limitations: The data generated by using a cross-sectional survey design has inherent design level limitation to capture cause and effect relationships. The survey has not attempted to include a matched comparison group of non-tribal rural mothers. Such an approach would have enabled the researchers to compare many of the socio-demographic characteristics to generate more reliable statistical inferences. Also in standard of living index, we adopted only initial 8 out of 27 items. All 27 items index would have given more robust estimate of general household standard of living of tribal infant-mother pairs. Hence, the readers may be considered these limitations in mind while weighing the findings of this study.

7. Conclusion

This study first estimates the 62.7% introduced CF at 6th month out of 1150 mother-infant pairs studied and then 22.7% children received potentially harmful CF and 48.4% received harmful CF. Evidently, 8.6% young children received optimal CF among tribal children, which reiterate the need for structural interventions to systematically address this issues. Maternal and paternal socio-demographic characteristics such as being married, higher age at first pregnancy, children's age and fathers' better education have significantly optimized CF. But being working, more working hours per day and work status before pregnancy have significantly reduced optimal CF to young children.

Disclosure of potential conflicts of interest

We would like to declare that none of the authors have any conflict of interest to publish the paper. This study is part of an Ad hoc project funded by Indian Council of Medical Research (ICMR), New Delhi with file no. R F C N o. RC H/Adhoc/32/2016-17 dated: March 28, 2017.

Research involving human participants/animals

This is a cross-sectional study where we have conducted surveys of tribal feeding mothers. We got approved by the Institutional Ethics Committee and apart from that all participants were informed about the need and purpose of the study and obtained written consent from them.

Informed consent

All participants were informed about the aim of the study and obtained written consent. Confidentiality were ensured throughout the study and we did not include their names and other personal identification details in the article.

Consent to participate

Informed consent was obtained from all individual participants included in the study.

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