Public Health Section

Factors Influencing Mothers to Initiate Early Complementary Feeding in Darjeeling, West Bengal

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ABSTRACT

Introduction: More than half of the infants are started on complementary feed before six months. Perception of Inadequate Milk supply (PIM) remains one of the most frequent causes of early institution of complementary feeding. Perception of Inadequate Weight Gain (PIWG), may also influence a mother's decision to start early complementary feeding which may be a consequence of PIM.

Aim: To find the proportion of early complementary feeding and to compare predictive models in identifying mothers who are more likely to initiate early complementary feeds.

Materials and Methods: A descriptive epidemiological study with cross-sectional design was carried out for three months between May-July 2013 among 99 mother-child dyads, with children in the 6-24 months age group, residing in Matigara block of West Bengal. Data were collected regarding infant feeding practices and prevalence of early complementary feeding was calculated. Logistic regression was done using SPSS Version 20.0 with the predictor variables classified under three constructs of socio-demography, health system related factors and mothers perceptions; and models were constructed using one, two or all three constructs.

Results: The proportion of early complementary feeding was 30.3%. In univariate analysis, none of the variables were found to be statistically significant. However, on multivariate analysis, Model (with all variables) was found to be statistically significant. The best Area Under Curve (AUC) was found with the inclusion of the socio-demography, health system related factors and mothers' perception.

Conclusion: The perception of the mother regarding adequacy of her milk production and regarding the child's weight gain are the most important predictors of early initiation of complementary feeding. All counselling activities for the mother should therefore be designed in a way as to address these issues.

INTRODUCTION

More than half of the infants are started on complementary feed before the WHO recommended age. Lack of knowledge among the mothers is often cited as the main reason for the same [1]. However, early complementary feeding has been seen to be prevalent even among women who were aware of the WHO recommended time of initiation [1-4]. Several determinants have been found to influence a mother's decision to start early complementary feeding. The sex of the child, maternal age, wealth and marital status of the mother and maternal and paternal education are a few of the socioeconomic factors that influence decisions regarding complementary feeding in mothers from Asia and Africa [2,5-11]. In the United States, studies have shown that low income African-American mothers had weaned children already during the first month of life with cereal in the bottle [12]. Other factors that have been shown to influence the timing of initiation of complementary feeding are Antenatal Care (ANC) follow up, postnatal care, and institutional delivery [5-9,11]. Employed mothers and home delivered mothers have been shown to have a higher risk of early initiation of complementary feeding [13].

Inadequate milk production, low enough to cause inadequate weight gain in infants is seen in less than 5% of mothers [14,15]. On the other hand, the PIM, remains one of the most common problems and the most frequent cause of cessation of breast milk feeding and early institution of complementary feeding [16,17]. About 23% to 56% of women who had weaned their children before the recommended duration cited PIM as the cause for the same [18,19]. PIM makes the mother more likely to stop breast feeding regardless of the age of the child [20,21]. Perception of Inadequate Weight Gain (PIWG) in infants during the early months, may also influences a mother's decision to start early

complementary feeding, either as a consequence of PIM or in the absence of it [22,23].

Despite the fact that a programmed effort to promote exclusive breast feeding till the age of six months is underway in the country, latest data (NFHS 4) show that only 52.3% of children under age six months are exclusively breastfed in West Bengal [24]. Identification of the reasons for this in the remaining half of children would be useful to health professionals to address the issues leading to early complementary feeding and to health officials attempting to device targeted interventions during health planning.

In this context, the present study attempts to find out the proportion of mothers that have started complementary feeding before the recommended period of six months and to compare predictive models to help identify mothers more likely to initiate early complementary feeds in their children.

MATERIALS AND METHODS

Study Design and the Participants

A descriptive epidemiological study with cross sectional designwas conducted during May-July 2013. Participants were mother-child dyads with children aged 6-24 months, residing in Matigara block of Darjeeling district, West Bengal, India. Exclusion criteria involved mothers who refused to give consent and children who were very ill.

Data Collection

All the Panchayat Headquarter sub-centres under Matigara block were visited and all mother-child dyads with children aged 6-24 months were recruited. Data were collected using a predesigned and pretested schedule administered to the mothers.

Questionnaire

The semi-structured questionnaire consisted of three sections:

- **Section I:** included questions on socio-demographic variables (age of child, sex of the child, religion, caste, literacy of care giver, per capita income of family, birth weight of the child).

- **Section II:** included questions on health system delivery related variables (place where the child was delivered, whether services were received before or after the initiation of IMNCI, post natal visits done by the health worker and pre-lacteal feed given to child).

- **Section III:** included variables recording the perception of the mother regarding the adequacy of breast milk and adequate weight gain in the children.

The questionnaire was customised for the study with the help of Integrated Management of Neonatal and Chilhood Illnesses (IMNCI) checklists [Appendix1] and data were collected by the investigators. Translation, back-translation, and re-translation of the prepared questionnaire was done with the help of language experts, followed by pre-testing among a convenience sample of 30 children attending the Immunization OPD of North Bengal Medical College and Hospital.

Sample Size Calculations

The proportion of children age 6-8 months receiving solid or semi-solid food and breast milk in West Bengal as reported in the National Family and Health Survey-4 (i.e., 52%), 24 was used for calculating the sample size. Sample size was computed by using the formula:

$$N = Z^2_{(1-\alpha/2)} p\ (1-p)/\ d^2$$

Where, p: Expected proportion, d: Absolute precision, 1- α/2: Desired Confidence level. Considering a 10% absolute precision (L), the final sample size comes out to be 96.

Outcome Variables

'Early initiation of complementary feeding' was the dichotomous outcome variable recorded as 'yes' or 'no'. Prevalence was calculated by dividing the number of children started on complementary feeding before six months by total number of children 6-24 months, included in the sample.

Exploratory Variables

The exploratory variables were classified under three constructs of socio-demography, health system related factors and mothers perceptions.

Ethical Committee Approval

The Institutional Ethics Committee of the North Bengal Medical College, Sushrutanagar, Darjeeling reviewed and cleared the proposal for the present study.

Data Analysis

Data were collected in predesigned and pretested questionnaires and handled with strict confidentiality. Data were entered into Excel (Microsoft Inc) and all calculations were done using IBM Statistical Package for the Social Sciences (SPSS) (Version 20.0, IBM).

STATISTICAL ANALYSIS

Data was analysed using principles of descriptive and analytical statistics. Univariate logistic regression was done to assess the unadjusted odds of the event. Multivariate logistic regression was carried out with all the variables irrespective of their significance on univariate results. Three models were constructed using one, two or all three constructs. Model 1 uses the socio-demographic constructs/ characteristics of mothers to predict early initiation of complementary feeding among the children. In model 2, both socio-demographic and health service related variables have been used

to model the prediction. Model 3 uses the variables related to the perception of the mother regarding adequacy of feeding and weight gain in the infant in addition to the variables in model 2. The Hosmer Leme show goodness of fit of the respective models along with the Cox & Snell and Nagelkerke R Square were also calculated.

RESULTS

Prevalence of Early Complementary Feeding

Among the 106 mother-child dyads, 99 (93.4%) finally participated in the study. Among them, the numbers of mother who weaned their child off breast milk before the recommended period of six months was 30 (30.3%).

Socio-demographic, Health Services Related and Variables Recording Mothers' Perception

The proportion of mothers with a male child, of Hindu religion, general caste, with no formal literacy, lower socioeconomic condition was 60.6%, 44.4%, 42.4%, 87.9% and 21.2%respectively. Higher proportion of mothers were illiterate (87.9%) but belonged to a higher socio-economic class (78.8%). Low birth weight (<2.5Kg) was seen in only one-fifth of the children (20.2%). Post natal visits were done in 94.9% cases, which was higher than 72.7% of deliveries that were conducted at health institutions. Prelacteal feeds were given 12.1% of the children. Approximately a fifth (21.2%) of the mothers perceived that their milk production was not enough for the child while 13.1% of the mothers thought that the child was not gaining weight despite regular feeding [Table/Fig-1].

Factors Associated with Timely Initiation of Complementary Feeding

- **Univariate analysis:**

  [Table/Fig-2] shows that early complementary feeding was more common if the child was male and other than Hindu or general caste. It was also more likely in caregivers with no formal literacy and with a higher SE class. Early initiation was more common if the child was less than 2.5 kg at birth or had been delivered at home. However, none of these differences were statistically significant. There was a significantly increased odd of the child being started on early complementary feeding if prelacteal feeds were given to the child or there were PIM and inadequate weight gain in the infant by the caregiver.

- **Multivariate analysis:**

  [Table/Fig-3,4] show three predictive models for predicting early initiation of breast feeding that were developed for the present study. Model 1 includes only the socioeconomic variables, Model 2 includes the socioeconomic and health system related variable and Model 3 includes the perception
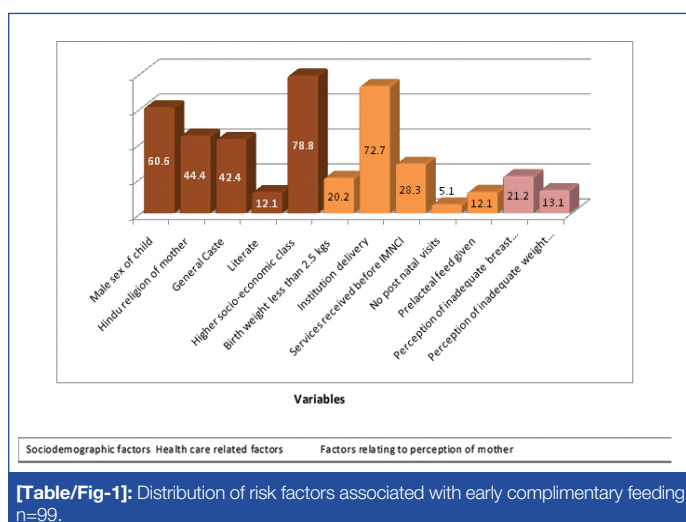
[Table/Fig-1]: Distribution of risk factors associated with early complimentary feeding. n=99.

of the mother regarding inadequate breast milk secretion and inadequate weight gain of the child in addition to the variables in model 2.

- **ROC curves and AUC:**

  The present study utilises the Receiver Operating Characterstic (ROC) curve (AUC) to compare models to predict early

complementary feeding. ROC curve is often used as a measure of quality of the classification models. It may be used to assess accuracy quantitatively or to compare accuracy between predictive models. The ideal model would be one with an AUC of 1 while an AUC of 0.5 corresponds to the flipping of a coin. The inclusion of the health system related factors improves (Model 2) over the model including only the socio-demographic variables (Model 1), while the addition of the mothers perception in Model 3 improves the AUC to 0.892 [Table/Fig-5].

Variables		Frequency of variables	Proportion of early complimentary feeding	COR (Confidence Interval)
Sex of the child	Female^	39	9 (23.1%)	1.795 (0.719 – 4.479)
	Male	60	21 (35.0%)	
Religion	Others ^	55	20 (36.4%)	0.515 (0.211-1.258)
	Hindu	44	10 (22.7%)	
Caste	Others ^	57	20 (35.1%)	0.578 (0.236, 1.414)
	General	42	10 (23.8%)	
Literacy of care giver	No formal literacy ^	87	28 (32.2%)	0.421 (0.087, 2.053)
	Literate	12	2 (16.7%)	
Per capita income of family	Lower SE class [Per capita income <Rs. 2000] ^	21	6 (28.6%)	1.111 (0.384. 3.213)
	Higher SE class [Per capita income ≥ Rs. 2000]	78	24 (30.8%)	
Birth weight of the child	2.5 kgs or more^	79	15 (19.0%)	3.109 (1.090, 8.872)*
	<2.5 kgs	20	9 (45.0%)	
Place where the child was delivered	Home^	27	9 (33.3%)	0.824 (0.319, 2.125)
	Institution	72	21 (29.2%)	
Services received in relation to IMNCI	After IMNCI^	71	23 (32.4%)	0.696 (0.259, 1.871)
	Before IMNCI	28	7 (25.0%)	
Post natal visits done by the health worker	PNC visit done^	94	27 (28.7%)	3.722 (0.589, 23.534)
	PNC visit not done	5	3 (60.0%)	
Pre-lacteal feed given to child	No^	87	23 (26.4%)	3.896 (1.124, 13.497)*
	Yes	12	7 (58.3%)	
Perception of inadequate milk production (PIM)	No^	78	16 (20.5%)	7.750 (2.683, 22.386)*
	Yes	21	14 (66.7%)	
Perception of inadequate weight gain (PIWG)	No^	86	22 (25.6%)	4.655 (1.377, 15.732)*
	Yes	13	8 (61.5%)	
Total population		99	30 (30.3%)	

[Table/Fig-2]: Variables used in the study and univariate analysis of early complimentary feeding.
N=99
^ denotes referent category, * denotes p<0.05.

DISCUSSION

Early initiation of complementary feeding remains prevalent even in women having correct knowledge of the time of initiation of complementary feeding [8,25-28]. Despite aggressive campaigns advocating exclusive breast feeding for the first six months of life, there has not been a substantial increase in the duration of exclusive breast feeding in India. Data from the NFHS-2 in 1998-1999 to the NFHS-3 in 2005 -2006 has not shown any substantial increase (from 41.2% to 46.3%) [29]. In West Bengal, the proportion of children under six months that are exclusively breastfeed is 58.6% as per the NFHS-3 [29]. Even among other developed and developing countries the early initiation of complementary feeding remains common [30,31].

Several factors have been identified from studies around the globe that consistently influence a mother's decision to initiate early complementary feeding in their children. These predictors can be broadly classified into three groups, namely, socio-demographic variables, health system related variables and perceptions of the mother. Socio-economic status, birth order, place of delivery, maternal and paternal education, male sex of the child were found to be statistically significant in studies conducted in India [1,32,33]. A study by Aggarwal et al., showed maternal education and paternal education were significantly related to timing of complementary feeding [32]. Among the health system related variables, women who had a history of antenatal care visit during their youngest child pregnancy period, gave their birth at health institution and had post natal visit tended to initiate complementary feeding timely.

Perceived inadequacy of milk supply or PIM is the most commonly reported problem by breast feeding mothers from all over the world. In a large section of these women, this leads to an early initiation of complementary feeding in their children [28,34]. A study in Bangladesh has observed that the common perception of "insufficient milk" was the main reasons for early initiation of complementary feeding in rural as well as urban children [35]. The findings were similar to the study by Semahegn et al., where the reason for too early initiation of complementary feeding was also the perceived inadequate breast milk production in 30.6% of the mothers [36].

Variables		Model 1	Model 2	Model 3
Intercept		-0.628	-2.643	-4.577
Socio-demographic variables	Sex(1)	2.08 (0.77, 5.61)	1.12 (0.35,3.66)	2.38 (0.49, 11.48)
	Religion_coded (1)	0.47 (0.17, 1.26)	0.69 (0.19,2.53)	0.70 (0.15, 3.38)
	Caste_coded (1)	0.41 (0.15, 1.10)	0.54 (0.17, 1.73)	0.28 (0.06, 1.30)
	Caregiver_literacy (1)	0.52 (0.10, 2.72)	0.38 (0.06, 2.26)	0.21 (0.02, 1.95)
	PCI_regrouped (1)	1.09 (0.36, 3.35)	1.77 (0.46,6.82)	4.08 (0.64, 25.85)
Health Service related variables	Birthplace (1)		0.19 (0.03, 1.10)	0.32 (0.04, 2.65)
	Birth_weight (1)		0.38 (0.09, 1.55)	0.23 (0.04, 1.41)
	Service_before_IMNCI (1)		3.51 (0.84, 14.60)	3.20 (0.58, 17.65)
	Any_PC_visit (1)		0.16 (0.01, 4.68)	0.12 (0.00, 5.55)
	Prelacteal_feed (1)		0.16 (0.03, 0.84)	0.31 (0.04, 2.46)
Variables relating to perception of mother	Perception_inadequate_milk (1)			29.55 (5.25, 166.39)*
	Perception_weight_gain (1)			16.90 (2.67, 107.04)*

[Table/Fig-3]: Multivariate models of early initiation of complimentary feeding.

	Omnibus Tests of Model Coefficients			Hosmer Lemeshow P	-2 Log likelihood	Nagelkerke pseudo R Square
	Chi-square	Degrees of freedom	Significance			
Model 1	7.827	5	.166	.499	113.628	.108
Model 2	16.481	10	.087	.409	89.129	.240
Model 3	41.033	12	.000	.398	64.576	.527

[Table/Fig-4]: Model statistics for the three predictive models.

ROC Curve

Diagonal segments are produced by ties.
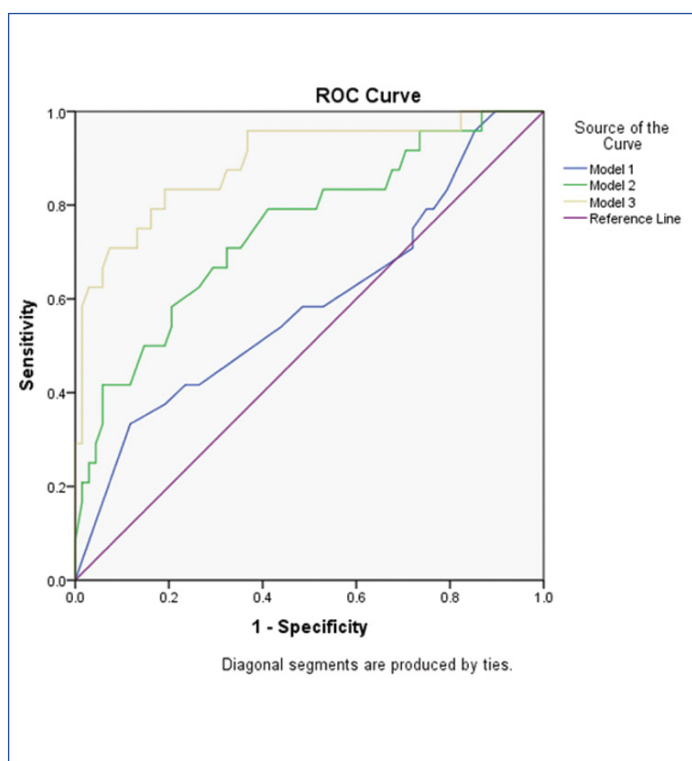
Area Under the Curve	
Test Result Variable(s)	**Area**
Model 1	0.591
Model 2	0.748
Model 3	0.892

[Table/Fig-5]: The test result variable(s): Model 1, Model 2, Model 3 has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

However, early weaning is not ubiquitous in mothers with PIM and has also been noted in women without PIM [37]. A systematic review by Gatti deduced that apart from the maternal perception of insufficient milk supply, other cited reasons for early cessation of breastfeeding were infant satiety, previous experience, etc., [34]. The Infant and Young Children Feeding (IYCF) Guidelines of the government of India discuss the importance and management of mother with an actual decrease in milk supply (Mothers with Inadequate Milk), but does not discuss the issue of PIM, which is seen more frequently than an actual decrease in breast milk production [38]. Breastfeeding mothers have been observed to have concerns of inadequate weight gain in children either as a consequence of PIM or in the absence of it [34]. In the present study, PIWG has been noted as a significant predictor of early complementary feeding singly or after adjusting for other factors including PIM.

LIMITATION

The limitations of the study include inherent weakness of cross sectional studies to deduce a causal association. In addition, the study was undertaken in children of age group 6-24 months and data collected could be biased due to the inability to recall all details of the older children by mothers or caregivers.

CONCLUSION

The present study utilises three models that include the three groups of variables to try and identify predictors most likely to identify mothers who will initiate early complementary feeding in their children. Results of the study clearly depict that after adjustment for other factors it is the perception of the mother regarding adequacy of her milk production and her perception regarding the child's weight gain were the most important predictors of early initiation of complementary feeding. All counselling activities for the mother should therefore be designed in a way as to address these issues.

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APPENDIX 1

Factors influencing mothers in Darjeeling, West Bengal to initiate early complementary feeding.

Questionnaire

Section I: Socio demographic profile

- Sex of the child: Male/ Female
- Religion : Hindu/ Muslim/ Christian/ Others (pl. specify.............................)
- Caste: General/ SC/ ST/ OBC
- Number of family members: ....
- Family income: Rs. ....
- Literacy of care giver: Years of education: ....
- Per capita income of family: ....

Section II: Birth history

- Birth weight of the child: .... grams
- Place where the child was delivered: ....
- Services received in relation to IMNCI: Before/ After
- Breastfeeding was started after how many hours of delivery? ....
- Pre-lacteal feed given to child: Yes/ No
- Post natal visits done by the health worker: Yes/ No (If yes, How many?...............
  ....)

Section III: Feeding history

- Do you breastfeed your child? Yes................................ No ....
- If Yes, how many times in 24 hours? .... times.
- Do you breastfeed during the night? Yes............................ No............................
- Does the child take any other food or fluids? Yes...
  No ....
- If Yes, what food or fluids? ....
- Why was the child given food other than breast milk? ....
  ....
- How many times per day? .... times
- When was semi solid food started? .... months
- Reasons for early initiation of complementary feeding: ....
  ....
- What do you use to feed the child? ....
- Who feeds the child and how? ....
- During the illness, has the child's feeding changed? Yes ....
  No .... If Yes, how? ....
- Perception of inadequate milk production (PIM): Present/ Absent
- Perception of inadequate weight gain (PIWG): Present/ Absent

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