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ORIGINAL ARTICLE

Knowledge, Attitude and Practice Regarding Foremilk–Hindmilk Balance Among Breastfeeding Mothers Attending a Tertiary Care Hospital in Tamil Nadu

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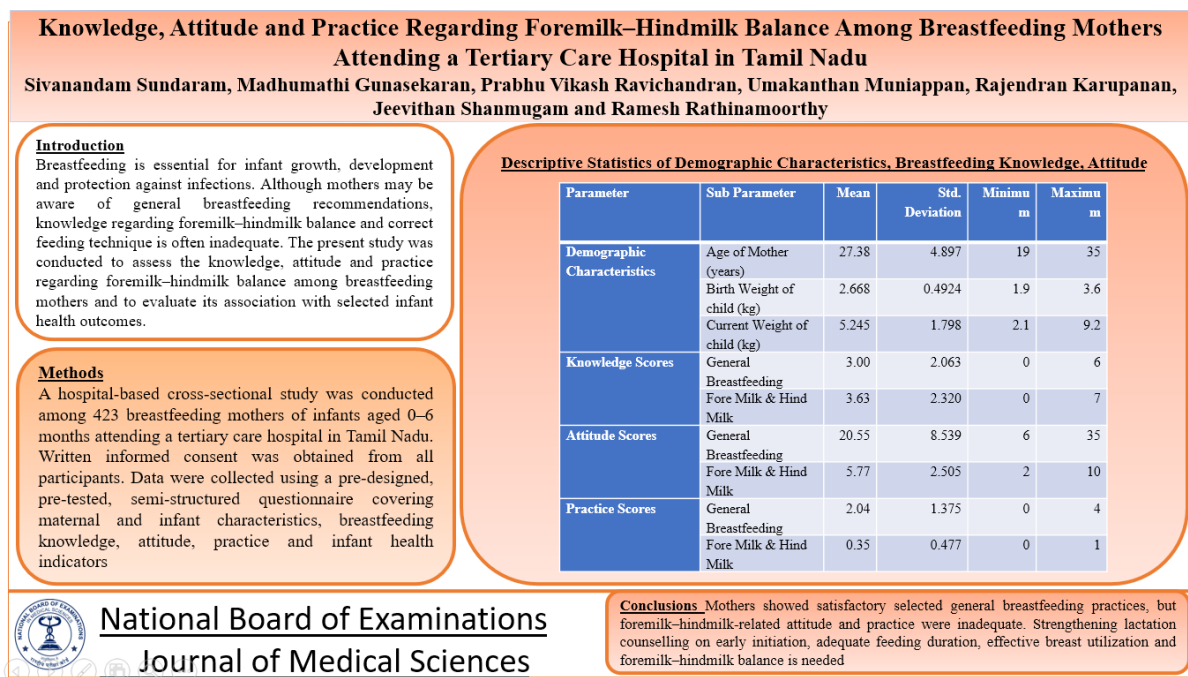
Abstract

Introduction: Breastfeeding is essential for infant growth, development and protection against infections. Although mothers may be aware of general breastfeeding recommendations, knowledge regarding foremilk–hindmilk balance and correct feeding technique is often inadequate. The present study was conducted to assess the knowledge, attitude and practice regarding foremilk–hindmilk balance among breastfeeding mothers and to evaluate its association with selected infant health outcomes. **Materials and Methods:** A hospital-based cross-sectional study was conducted among 423 breastfeeding mothers of infants aged 0–6 months attending a tertiary care hospital in Tamil Nadu. Written informed consent was obtained from all participants. Data were collected using a pre-designed, pre-tested, semi-structured questionnaire covering maternal and infant characteristics, breastfeeding knowledge, attitude, practice and infant health indicators. **Results:** Among 423 breastfeeding mothers, the mean age was 27.38 ± 4.897 years. Good knowledge was observed in 43.7% for general breastfeeding and 53.0% for foremilk–hindmilk balance. Good attitude was present in 50.6% for general breastfeeding and 35.7% for foremilk–hindmilk balance, while good practice was observed in 40.2% and 34.8%, respectively. Maternal education and parity were not significantly associated with domain-wise KAP scores. **Conclusion:** Mothers showed satisfactory selected general breastfeeding practices, but foremilk–hindmilk-related attitude and practice were inadequate. Strengthening lactation counselling on early initiation, adequate feeding duration, effective breast utilization and foremilk–hindmilk balance is needed.

Keywords: Breastfeeding, Foremilk, Hindmilk, Diarrhoea

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Graphical Abstract



Introduction

Breastfeeding is one of the most important public health interventions for improving infant survival, growth and development. The World Health Organization (WHO) and United Nations International Children's Emergency Fund (UNICEF) recommend initiation of breastfeeding within the first hour of birth, exclusive breastfeeding for the first six months of life, and continued breastfeeding up to two years or beyond with appropriate complementary feeding. Optimal breastfeeding practices are estimated to prevent more than 820,000 deaths among children under five years annually, emphasizing their importance in reducing infant and child morbidity and mortality [1].

Breast milk is a dynamic biological fluid that changes in composition during lactation and even during a single feed. Milk available at the beginning of a feed is commonly referred to as foremilk, while

milk obtained later in the feed is referred to as hindmilk. These are not two separate types of milk; rather, the fat content of breast milk gradually increases as the breast is drained [2]. A lipidomic analysis of human breast milk demonstrated differences in lipid composition between foremilk and hindmilk, supporting the concept that milk composition changes during a feeding episode [3]. Hence, adequate feeding duration and effective breast emptying are important to ensure that infants receive sufficient milk volume and energy.

Inadequate breastfeeding technique, frequent switching between breasts, short feeding duration, and ineffective latch may interfere with adequate milk transfer. These practices may contribute to concerns regarding foremilk–hindmilk imbalance, which is commonly associated with infant fussiness, gassiness, frequent stools, and poor satiety. However, lactation guidance emphasizes that the focus should not be on

rigid separation of foremilk and hindmilk, but on ensuring effective latch, feeding on demand, adequate feeding duration, and allowing the infant to complete feeding from one breast before switching when appropriate [2].

Breastfeeding also has a protective role against diarrhoeal morbidity in infancy. Exclusive breastfeeding has been consistently associated with reduced risk of gastrointestinal infections. A rapid review and meta-analysis reported that exclusive breastfeeding was associated with a 43% reduction in diarrhoea risk among infants aged 0–6 months [4]. Similarly, reviews of childhood morbidity have shown that exclusive breastfeeding reduces the risk of gastrointestinal, respiratory, and other infectious illnesses in early childhood [5].

In India, breastfeeding promotion remains a major maternal and child health priority. National-level data from NFHS-4 and NFHS-5 have shown that exclusive breastfeeding practices are influenced by maternal, infant and health-system-related factors [6]. Studies from Indian tertiary care settings, including Southern Tamil Nadu, have also reported gaps in breastfeeding knowledge, attitude and practice among mothers of infants below six months [7]. However, limited evidence is available regarding mothers' understanding of foremilk–hindmilk balance and related feeding techniques. Misconceptions regarding foremilk and hindmilk may lead to maternal anxiety, inappropriate switching of breasts, inadequate feeding duration, unnecessary supplementation and suboptimal breastfeeding practice.

Therefore, the present study was undertaken to assess the knowledge, attitude, and practice regarding foremilk–hindmilk balance among breastfeeding mothers of infants aged 0–6 months

attending a tertiary care hospital in Tamil Nadu.

Materials and methods

This Prospective cross sectional study was conducted among breastfeeding mothers of infants aged 0–6 months attending the Paediatric Department of a tertiary care hospital in Tamil Nadu. Mothers who were currently breastfeeding and willing to participate were included in the study. Mothers who were not breastfeeding due to maternal illness, neonatal illness, or any other reason were excluded from the study. The final study population consisted of 423 breastfeeding mothers. Written informed consent was obtained from all eligible breastfeeding mothers before enrolment into the study. The purpose of the study was explained to the participants in their local language, and confidentiality of the information collected was assured.

Data were collected using a pre-designed, pre-tested, semi-structured questionnaire. The questionnaire included details regarding maternal and infant characteristics, knowledge about breastfeeding and foremilk–hindmilk balance, attitude towards breastfeeding, breastfeeding practices, and selected infant health characteristics. Knowledge-related questions included timing of breastfeeding initiation, recommendation regarding prelacteal feeds, recommended duration of exclusive breastfeeding, awareness of foremilk and hindmilk, type of milk the baby should receive, methods to ensure receipt of both foremilk and hindmilk, and breast utilization technique during each feed. Attitude-related questions assessed the mothers' opinion regarding timing of breastfeeding initiation and prelacteal feeding. Practice-related questions included

actual timing of breastfeeding initiation, history of prelacteal feeding, exclusive breastfeeding practice, feeding technique, and average duration of each breastfeeding session.

Infant-related data included birth weight, history of diarrhoea or acute gastroenteritis, history of taking the child to a doctor for diarrhoea, history of hospital admission due to diarrhoea, sleep pattern, stool frequency, urination frequency, constant fussiness, abdominal distension or perianal excoriation, and difficulties encountered during breastfeeding. The responses were coded as appropriate or inappropriate for knowledge items, positive or negative for attitude items, and correct or incorrect for practice items. Individual scores were calculated for knowledge, attitude, and practice based on the number of appropriate or correct responses.

The collected data were entered in Microsoft Excel and analysed using SPSS 28 software. Descriptive statistics were used to summarize the data. Categorical variables were expressed as frequency and percentage. Knowledge, attitude, and practice scores were presented as score distributions. Association between selected categorical knowledge, attitude, and practice variables and infant health outcomes, particularly diarrhoea or acute gastroenteritis, was assessed using the Chi-

square test. A p value of less than 0.05 was considered statistically significant.

Results

The study included 423 participants, with almost equal representation of primipara 215 (50.8%) and multipara 208 (49.2%) mothers. Most participants had completed school education 163 (38.5%), followed by primary education 117 (27.7%) and graduate and above 107 (25.3%), while only 3 (0.7%) were illiterate. Vaginal delivery was the commonest mode of delivery, reported among 304 mothers (71.9%), whereas 119 (28.1%) had undergone caesarean section. Among multipara mothers, spacing between pregnancies was more than 2 years in 143 (68.8%) and 2 years or less in 65 (31.2%). The infants were fairly distributed across the age group of neonate to 6 months, with neonates forming 68 (16.1%) and 6-month-old infants forming 53 (12.5%). Male children were slightly more common, 229 (54.1%), compared to female children, 194 (45.9%). With regard to birth weight, 226 infants (53.4%) had birth weight between 2.5 and ≤ 3.5 kg, while 183 (43.3%) had birth weight ≤ 2.5 kg and 14 (3.3%) had birth weight of > 3.5 kg. Diarrhoea was reported in 91 infants (21.5%), while 332 (78.5%) did not have diarrhoea (Table 1).

Table 1. Distribution of study participants based on Socio-Demographic, Obstetric, and Child Baseline Characteristics

Parameter	Sub Classification	Frequency (n)	Percentage (%)
Parity	Primipara	215	50.8
	Multipara	208	49.2
Education	Illiterate	3	0.7
	Just literate	33	7.8
	Primary completed	117	27.7
	School completed	163	38.5
	Graduate and above	107	25.3
Mode of Delivery	Vaginal	304	71.9
	C-section	119	28.1
Spacing Between Pregnancies(n=208)	> 2 years	143	68.8
	≤ 2 years	65	31.2
Age of child	Neonate	68	16.1
	1 month	63	14.9
	2 months	61	14.4
	3 months	64	15.1
	4 months	57	13.5
	5 months	57	13.5
	6 months	53	12.5
Sex of Child	Male	229	54.1
	Female	194	45.9
Birth Weight	≤2.5kg	183	43.3
	2.5 - ≤3.5kg	226	53.4
	>3.5kg	14	3.3
Diarrhoea	Yes	91	21.5
	No	332	78.5

The mean age of mothers was 27.38 ± 4.897 years, with ages ranging from 19 to 35 years. The mean birth weight of the children was 2.668 ± 0.4924 kg, while the mean current weight was 5.245 ± 1.798 kg. Among the knowledge domains, the mean score for general breastfeeding knowledge was 3.00 ± 2.063 out of a possible score range of 0–6, whereas the mean score for

foremilk–hindmilk knowledge was 3.63 ± 2.320 . The mean attitude score for general breastfeeding was 20.55 ± 8.539 , while the mean attitude score for foremilk–hindmilk balance was 5.77 ± 2.505 . Practice scores were comparatively lower, with a mean general breastfeeding practice score of 2.04 ± 1.375 and a mean foremilk–hindmilk practice score of 0.35 ± 0.477 (Table 2).

Table 2. Descriptive Statistics of Demographic Characteristics, Breastfeeding Knowledge, Attitude, and Practice Scores (n= 423)

Parameter	Sub Parameter	Mean	Std. Deviation	Minimum	Maximum
Demographic Characteristics	Age of Mother (years)	27.38	4.897	19	35
	Birth Weight of child (kg)	2.668	0.4924	1.9	3.6
	Current Weight of child (kg)	5.245	1.798	2.1	9.2
Knowledge Scores	General Breastfeeding	3.00	2.063	0	6
	Fore Milk & Hind Milk	3.63	2.320	0	7
Attitude Scores	General Breastfeeding	20.55	8.539	6	35
	Fore Milk & Hind Milk	5.77	2.505	2	10
Practice Scores	General Breastfeeding	2.04	1.375	0	4
	Fore Milk & Hind Milk	0.35	0.477	0	1

The domain-wise score distribution showed that good general breastfeeding knowledge was present in 185 participants (43.7%), while 238 (56.3%) had poor general breastfeeding knowledge. In contrast, good foremilk–hindmilk knowledge was observed in 224 participants (53.0%), while 199 (47.0%) had poor knowledge in this domain. General breastfeeding attitude was almost equally distributed, with 214 participants

(50.6%) having good attitude and 209 (49.4%) having poor attitude. However, attitude towards foremilk–hindmilk balance was lower, with only 151 participants (35.7%) showing good attitude and 272 (64.3%) having poor attitude. Practice scores were poor in both domains, with good general breastfeeding practice seen in 170 participants (40.2%) and good foremilk–hindmilk practice in only 147 participants (34.8%) (Table 3).

Table 3. Distribution of Study Participants According to Domain-wise Knowledge, Attitude and Practice Scores on General Breastfeeding and Foremilk–Hindmilk Balance

Parameters	Sub Group	Poor		Good	
		F	%	F	%
Knowledge	General Breastfeeding	238	56.3	185	43.7
	Foremilk- Hind milk	199	47.0	224	53.0
Attitude	General Breastfeeding	209	49.4	214	50.6
	Foremilk- Hind milk	272	64.3	151	35.7
Practice	General Breastfeeding	253	59.8	170	40.2
	Foremilk- Hind milk	276	65.2	147	34.8

The association analysis showed that maternal education and parity were not significantly associated with any of the domain-wise knowledge, attitude or practice scores. General breastfeeding knowledge was not significantly associated with education ($\chi^2 = 0.669$, $p = 0.955$) or parity ($\chi^2 = 1.168$, $p = 0.280$). Similarly, foremilk–hindmilk knowledge showed no

significant association with education ($\chi^2 = 4.208$, $p = 0.379$) or parity ($\chi^2 = 1.942$, $p = 0.163$). General breastfeeding attitude, foremilk–hindmilk attitude, general breastfeeding practice and foremilk–hindmilk practice were also not significantly associated with either education or parity, as all p values were greater than 0.05 (Table 4).

Table 4. Association of selected domain-wise KAP scores with maternal education and parity

Domain	Variable	Chi-square value	p value	Inference
General breastfeeding knowledge	Education	0.669	0.955	Not significant
	Parity	1.168	0.280	Not significant
Foremilk–hindmilk knowledge	Education	4.208	0.379	Not significant
	Parity	1.942	0.163	Not significant
General breastfeeding attitude	Education	3.902	0.419	Not significant
	Parity	0.959	0.327	Not significant
Foremilk–hindmilk attitude	Education	1.271	0.866	Not significant
	Parity	0.252	0.616	Not significant
General breastfeeding practice	Education	2.921	0.571	Not significant
	Parity	1.624	0.203	Not significant
Foremilk–hindmilk practice	Education	0.390	0.983	Not significant
	Parity	0.218	0.683	Not significant

Discussion

The present study assessed selected knowledge, attitude and practice-related domains regarding general breastfeeding and foremilk–hindmilk balance among breastfeeding mothers of infants aged 0–6 months attending a tertiary care hospital in Tamil Nadu. The study showed that responses varied across domains, with better knowledge related to foremilk–

hindmilk balance than general breastfeeding, but lower attitude and practice scores in the foremilk–hindmilk domain.

In the present study, the participants represented a mixed group of breastfeeding mothers, with almost equal distribution of primipara and multipara mothers. Most mothers had some level of formal education, and vaginal delivery was the

commonest mode of delivery. The infants were distributed across the age range of neonate to 6 months, and diarrhoea was reported among nearly one-fifth of infants. These baseline characteristics indicate that the study population was suitable for assessing breastfeeding-related responses during the early infancy period, which is the critical period for exclusive breastfeeding and appropriate feeding practices.

The mean knowledge score for general breastfeeding was 3.00 ± 2.063 , while the mean knowledge score for foremilk–hindmilk balance was 3.63 ± 2.320 . In the domain-wise classification, good general breastfeeding knowledge was observed in 43.7% of participants, whereas good foremilk–hindmilk knowledge was observed in 53.0%. This finding suggests that although awareness regarding foremilk–hindmilk balance was present among nearly half of the mothers, a considerable proportion still had poor knowledge in both domains. Breastfeeding counselling programmes commonly emphasize early initiation, exclusive breastfeeding, avoidance of prelacteal feeds and continuation of breastfeeding, in line with WHO recommendations [1]. However, the concept of foremilk–hindmilk balance may not be routinely explained in a simple and practical manner during antenatal or postnatal counselling sessions.

The finding that foremilk–hindmilk knowledge was only moderate is important because breast milk composition changes during a feed, and effective feeding duration and breast emptying are required for adequate milk transfer. Foremilk and hindmilk are not two separate types of milk; rather, the fat content of breast milk gradually increases as the feed progresses [2,3]. Hence, mothers should be counselled

to focus on effective latch, feeding on demand, adequate duration of feeding and allowing the infant to complete feeding adequately rather than prematurely switching breasts. Inadequate understanding of this concept may lead to anxiety, inappropriate feeding practices or unnecessary supplementation.

The present study showed that attitude scores were comparatively better for general breastfeeding than for foremilk–hindmilk balance. Good general breastfeeding attitude was observed in 50.6% of participants, whereas good attitude towards foremilk–hindmilk balance was observed in only 35.7%. This indicates that even when mothers have some knowledge regarding foremilk–hindmilk balance, it may not necessarily translate into a favourable attitude towards related feeding practices. Similar gaps between breastfeeding knowledge, attitude and practice have been reported in Indian studies, where mothers may be aware of recommended breastfeeding practices but may not consistently follow them due to practical barriers [8,9]. Such barriers may include maternal fatigue, caesarean delivery, pain, poor latch, perceived insufficient milk, family advice and inadequate postnatal support.

Practice scores were lower than knowledge and attitude scores in both domains. Good general breastfeeding practice was seen in 40.2% of participants, while good foremilk–hindmilk practice was seen in only 34.8%. This suggests that practice remains the weakest component, particularly for foremilk–hindmilk-related feeding behaviour. The low practice score may reflect the difficulty of translating advice into actual feeding behaviour without direct support and demonstration. Breastfeeding is a skill-based practice, and

mothers may require repeated counselling, observation of feeding, correction of latch and reassurance regarding infant behaviour. Therefore, practical lactation counselling may be more effective than knowledge-based health education alone.

The relatively lower foremilk–hindmilk attitude and practice scores in the present study are comparable with the study by Siregar, which reported gaps in mothers' knowledge regarding foremilk and hindmilk among mothers of infants aged 0–6 months [10]. This suggests that foremilk–hindmilk balance remains a relatively less emphasized area in routine breastfeeding education. While general messages regarding breastfeeding are widely promoted, practical aspects such as adequate feeding duration, breast utilization technique and effective milk transfer require more emphasis.

The present study found no significant association between maternal education and any of the domain-wise knowledge, attitude or practice scores. Similarly, parity was not significantly associated with general breastfeeding or foremilk–hindmilk-related knowledge, attitude or practice. This finding suggests that gaps in breastfeeding-related domains were not confined to mothers with lower education or to primipara mothers alone. Even educated mothers and multipara mothers may require structured breastfeeding counselling. Therefore, lactation counselling should be universal and should not be restricted only to specific high-risk groups.

Diarrhoea was reported in 91 infants (21.5%) of infants in the present study. Breastfeeding is known to have a protective role against gastrointestinal infections, and exclusive breastfeeding has been associated with reduced diarrhoeal

morbidity among infants [1,4,5]. However, the present analysis focused primarily on domain-wise KAP scores and their association with maternal education and parity. Since diarrhoea is multifactorial, it may be influenced by sanitation, hygiene, environmental exposure, complementary feeding practices, bottle feeding and health-seeking behaviour. These factors should be considered in future studies exploring the relationship between breastfeeding practices and infant diarrhoeal morbidity.

The findings of the present study have important public health implications. The moderate knowledge scores and lower practice scores indicate the need to strengthen breastfeeding counselling beyond routine messages. Counselling should include practical demonstration of latch, advice on feeding on demand, adequate duration of feeding, avoidance of premature switching between breasts and reassurance regarding normal variations in infant stooling, sleep and feeding behaviour. Foremilk–hindmilk balance should be explained in a simple, non-alarming manner so that mothers understand the importance of effective milk transfer without developing unnecessary anxiety.

The study has certain limitations. The study was hospital-based and may not represent all breastfeeding mothers in the community. Some responses were self-reported and may be affected by recall bias or social desirability bias. Since the study was cross-sectional, causal relationships could not be established.

Conclusion

The study showed that breastfeeding mothers had variable knowledge, attitude and practice-related responses regarding general breastfeeding

and foremilk–hindmilk balance. Knowledge regarding foremilk–hindmilk balance was comparatively better than general breastfeeding knowledge, but attitude and practice in this domain were inadequate. Maternal education and parity were not significantly associated with domain-wise scores, indicating that counselling gaps were present across all groups. Universal, practical lactation counselling focusing on adequate feeding duration, effective breast utilization and foremilk–hindmilk balance should be strengthened during antenatal and postnatal care.

Statements and Declarations

Conflicts of interest

The authors declare that they do not have conflict of interest.

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