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COLOSTRUM FEEDING BEHAVIOUR AND INITIATION OF BREAST-FEEDING IN RURAL BANGLADESH

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Summary. Human breast milk is primarily colostrum immediately following birth. Colostrum gradually changes to mature milk over the next several days. The role of colostrum in fighting infections and promoting growth and development of the newborn is widely acknowledged. This role is mediated by differences across cultures in the acceptability of colostrum and the prevalence of colostrum feeding. This study examined the prevalence of colostrum feeding and time to initiation of breast-feeding in 143 rural Bangladeshi women in Matlab thana. Structured interviews were collected during a 9-month prospective study conducted in 1993. Women were usually interviewed within 4 days of giving birth and were asked about whether or not they fed their child colostrum and the number of hours until they began breast-feeding the baby. Ninety per cent of the mothers reported feeding their newborn colostrum. A logistic regression found no effect on the prevalence of colostrum feeding from the following covariates: mother's age, parity, history of pregnancy loss, child's sex, mother's self-report of delivery complications, and the time from birth to interview. Fifty-nine per cent of mothers initiated breast-feeding within 4 h, and 88% within 12 h of parturition. Survival analysis was used to estimate the effects of covariates on the time from delivery to initial breast-feeding. Time to initial breast-feeding was delayed slightly, but significantly, for older mothers, for male infants, and by mothers who did not report delivery complications. The percentage of mothers who fed their child colostrum was higher, and times to initial breast-feeding were shorter, than almost all previous reports from South Asia. These findings might be explained, in part, by methodological differences among studies, but it is

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suggested that recent changes towards earlier initiation of breast-feeding have taken place in rural Bangladesh.

Introduction

The role of colostrum in fighting infections and promoting growth and development of the newborn is widely acknowledged. Colostrum feeding is thought to decrease infant morbidity, especially in non-industrialized populations, by reducing the risk of gastroenteritis (Cruz *et al.*, 1982), diarrhoeal disease (Feachem & Koblinsky, 1984; Popkin *et al.*, 1990), respiratory infections, ear infections and influenza (Shortlidge, Lawton & Choi, 1990). These benefits are thought to arise from both the passive immunity conferred through colostrum, and by reducing or eliminating unsafe prelacteal feeding practices (Hanson *et al.*, 1985a, b). Following birth, human breast milk is primarily colostrum, and has a high content of anti-infective agents and growth-promoting factors (Hartmann *et al.*, 1985). By day two postpartum breast milk has changed substantially and more closely resembles mature milk. Even so, breast milk continues changing to mature milk over several more weeks (Humenick *et al.*, 1994).

For many years ethnographic accounts have created the impression that withholding colostrum from newborns is commonplace in many cultural settings. In a survey of the ethnographic literature, Morse, Jehle & Gamble (1990) found that of 120 cultures sampled, 50 did not initiate breast-feeding until at least 2 days after birth, thus implying that mothers were denying their infants colostrum. Earlier studies of infant feeding practices from South Asia reported delayed initiation of breast-feeding for 2–4 days after birth (Rao *et al.*, 1959; Lindenbaum, 1966). In Bangladesh, this has led many researchers and health professionals to view colostrum rejection as nearly universal (Rizvi, 1993). In a recent report on the feeding of colostrum in rural Bangladesh, Rizvi (1993) challenges this view on methodological grounds. She contends that methodological inadequacies of earlier work have led to underestimation of the frequency of colostrum feeding in rural Bangladesh, and possibly other geographic areas as well. Rizvi argues that previous studies failed to define certain terms precisely, such as colostrum feeding, withholding, and discarding and rejection of colostrum. This lack of clarification of these terms, she contends, made it impossible to determine if mothers denied their infants colostrum totally, partially or symbolically. In fact, she points to cases where mothers reported that they rejected colostrum, but initiated breast-feeding shortly after birth. Moreover, she makes the claim that previous studies have inaccurately equated prelacteal feeds with colostrum rejection. Finally, she points out that previous studies ignored intragroup variations in colostrum feeding.

Quantitative studies that address colostrum feeding behaviour are rare relative to studies of other components of breast-feeding. Those that do exist have demonstrated that colostrum feeding behaviour and time to initiation of breast-feeding vary substantially both among and within different populations. Examples from the Indian sub-continent include a study by Subbulakshmi, Udipi & Nirmalamma (1990) from India in which 22% of children were fed colostrum. Kulsoom & Saeed (1997) found in their study from Lahore, Pakistan, that 34·6% of children were fed colostrum;

Banapaurmath *et al.* (1996) reported a 71·4% prevalence of colostrum feeding in Karnataka, India. In a study conducted from 1982 to 1985 in rural Bangladesh, Rizvi (1993) found that colostrum feeding was nearly universal, although she did not quantify the prevalence. Haider, Kabir & Ashworth (1999) reported a prevalence of 99% in Dhaka, Bangladesh, in 1995. Studies from other areas of the world show a similar range. Hull, Thapa & Pratomo (1990) found that 35% of children were fed colostrum in a 1985 study in urban Indonesia, and Büyükgebiz, Çevik & Oran (1993) found that 68·8% of children were fed colostrum in Ankara, Turkey. One conclusion that can be drawn from these studies is that *total* colostrum rejection is rare. Variation within populations in colostrum feeding behaviour and initiation of breast-feeding has been associated with ethnic affiliation (Gunnlaugsson, da Silva & Smedman, 1992), mother's education (Singhania, Kabra & Bansal, 1990; Gunnlaugsson *et al.*, 1992; Somaiya & Awate, 1990; Davies-Adetugbo & Ojofeitimi, 1996), child's sex (Chowdhury, Islam & Chakraborty, 1997), mother's age and parity (Gunnlaugsson *et al.*, 1992; Kishore *et al.*, 1995), antenatal care (Nielsen *et al.*, 1998; Davies-Adetugbo, 1996), site of delivery (Rizvi, 1993; Hull *et al.*, 1990), complications of delivery (Hull *et al.*, 1990; Banapaurmath & Selvamuthukumarasamy, 1995) and socioeconomic status (Davies-Adetugbo, 1997; Singhania *et al.*, 1990; Somaiya & Awate, 1990).

Infant feeding practices in many parts of the world have been undergoing considerable change in the last several decades (Walia *et al.*, 1987; Knodel, Chayovan & Wongboonsin, 1990). In many non-industrial settings public health measures have been promoting early initiation and sustained breast-feeding. For this reason discrepancies between results from studies carried out in the 1950s, 60s and 70s versus those done more recently may be the result of changes in these behaviours brought about by the success of public health measures (Walia *et al.*, 1987).

The purpose of this study is to examine the prevalence of colostrum feeding and time to initiation of breast-feeding in rural Bangladeshi women based on structured interviews in a 9-month prospective study. Factors that affected the proportion of women who fed their children colostrum, and factors that affected the time to initiation of breast-feeding were examined. The effect of study design was examined by comparing results obtained from interviews taken shortly after parturition with those taken weeks and months after parturition. This study also provides an independent test in another area of Bangladesh of Rizvi's (1993) finding that colostrum feeding is nearly universal in rural Bangladesh.

Subjects and methods

The field setting

This study was part of a larger 11-month prospective study of birth spacing and fecundity conducted in 1993 among 28 rural Bangladeshi villages in Matlab thana, a rural administrative unit located 45 km south-east of the capital city of Dhaka (Holman, 1996). The study area is situated in a low-lying delta intersected by tributaries of the Meghna and Gomuti rivers. The climate is subtropical with temperatures ranging from 10 to 35 °C over three major seasons (monsoon, cool–dry

and hot–dry). The primary economy of the region is subsistence farming of rice and jute, and fishing. The smallest settlement unit is the *bari*, which is a cluster of patrilineally related households (Bhuiya & Mostafa, 1993). Houses are constructed from jute sticks and mud, usually with tin roofs. In most areas, drinking water is available from tubewells, but surface water is used for most ordinary purposes (Bhuiya & Streatfield, 1992). Cholera is endemic in the area. Health care is largely traditional; however, government and private health intervention programmes provide limited Western medical services to the study area. Homeopathic and herbal medicines are common, and are administered by village practitioners (Bhuiya & Streatfield, 1992). The society is largely Muslim and religiously conservative. About 55% of males and 27% of females beyond age 15 have formal education (Bhuiya & Mostafa, 1993).

Most of Matlab thana is part of an ongoing large survey of demography, health, family planning and disease conducted by the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). The ICDDR,B has maintained a demographic surveillance in the Matlab study area since 1966, including a continuous registration of such vital events as births, deaths, marriages, divorce and migrations, as well as periodic censuses. The demographic surveillance includes visits to each of the households in the area once every 2 weeks (Strong, 1992). Currently, the project covers about 200,000 people in 143 villages. One-half of the villages are part of a Maternal and Child Health and Family Planning intervention area and the other half are in an area designated as a non-intervention or comparison area (ICDDR,B, 1992). This study was conducted among villages in the comparison (non-intervention) area.

Fieldworkers

Eight adult female Bangladeshi field assistants were employed to interview subjects throughout the study. The field assistants resided in or adjacent to the village in which they worked. All had at least a 10th grade education (secondary school certificate). The eight field assistants were supervised by a female senior health assistant who had extensive experience in reproductive and health studies in the study area. The supervisor visited each field assistant in the field every 3 or 4 days, answered questions, checked questionnaires for errors, and provided re-training to the field assistants.

Subject selection and eligibility

A baseline survey was conducted in February 1993 among all households in 28 villages, in which a total of 3290 married women from 18 to 48 years of age were interviewed. A longitudinal follow-up study was conducted from March to November 1993. Subjects for the follow-up study were selected from seventeen baseline villages in which the contraceptive prevalence was lowest. To be eligible for the follow-up study, a woman had to be 18 to 48 years old, married, living with her husband and not contracepting. Subjects of all reproductive statuses were included in the study and were interviewed twice each week until the study ended or until shortly after their next delivery. Subjects who gave birth were followed for an additional period of up to

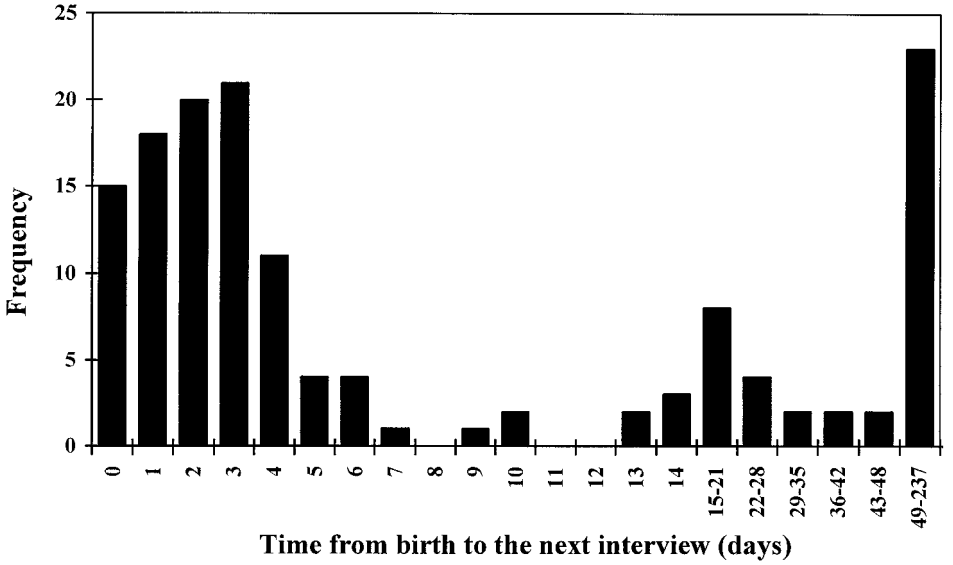

Fig. 1. Frequencies of times from when a mother gave birth until her next interview.

1 month before becoming ineligible for the study. Continuous recruitment was used so that about 325 subjects were interviewed each week. When a subject dropped out or became ineligible for the study, she was replaced by a randomly selected eligible baseline subject from the same village. Thus, some subjects who were newly selected for the follow-up study had given birth in the interval from their baseline interview until their first follow-up interview, and answers about colostrum and initiation of breast-feeding were recalled from up to 8 months before the interview. For most subjects, however, answers were recalled over a period no more than 4 days.

Subjects were interviewed twice weekly in their homes. By the end of the birth-spacing study, 708 women provided one or more interviews; of these, 143 women gave birth during the follow-up study and were interviewed about early breast-feeding behaviour. The distribution of times from birth to the next interview is shown in Fig. 1. The median time is 3 days from birth to the next interview, but the upper tail represents cases where either the subjects refused one or more interviews following birth, had travelled elsewhere for the delivery, or gave birth between the baseline survey and their first follow-up interview.

Questionnaires

Project questionnaires were translated into Bengali and checked by two Bangladeshi research staff members at the International Centre for Diarrhoeal Disease Research, Bangladesh; they were then back-translated into English by a different translator and checked for errors and ambiguities. The questions concerned menstrual cycles, pregnancy status, pregnancy outcome, contraception, breast-feeding behaviour and symptoms of illness. The section on pregnancy outcome included questions on the sex

of the child, complications of delivery, whether or not the child was given colostrum, whether or not the child was ever breast-fed and, if so, the number of hours until the child was first breast-fed. The question on initiation of breast-feeding was worded 'After giving birth, how many hours until the baby was given to the breast?' The interviewer recorded 'never', 'unknown' or the number of hours that the subject reported. The question on colostrum was worded: 'Did you feed the baby colostrum?' to which the interviewer recorded 'yes', 'no' or 'unknown'.

No answer to the colostrum question was obtained for thirteen women who gave birth after their last follow-up interview but before an exit interview in November. The exit interview ascertained breast-feeding status, but did not ask about colostrum feeding.

Information on age and parity was collected from the ICDDR,B demographic records. These were known exactly for most women. Women who were born before 1966 and those who migrated into the study area had estimated ages and parity taken from entrance interviews by ICDDR,B. Questionnaires were entered into the computer within a few days of interview. The data entry programme checked for inconsistencies, errors or missing items, and when any were found a copy of the questionnaire was given to the field assistant who met with the fieldworker to resolve the error.

Informed consent was obtained from all subjects. All aspects of the study protocol were reviewed and approved by the Pennsylvania State University Human Subjects Committee and the International Centre for Diarrhoeal Disease Research, Bangladesh Research and Ethical Review Committees.

Statistical methods

The variables included in the analyses were: maternal age, parity, history of pregnancy loss, child's sex, time from birth to interview and the mother's self-report of any delivery complications. For all analyses, x_{ij} is the value for the j^{th} measured covariate for the i^{th} subject. Parameter estimates for covariate effects are denoted as β. Thus, an array of m covariates is constructed for the i^{th} subject as:

$$\boldsymbol{x_i'\beta} = x_{i1}\beta_1 + x_{i2}\beta_2 + \ldots + x_{im}\beta_m.$$

The effects of covariates on both the probability of giving colostrum as well as on the time to first breast-feeding were examined. The effects of covariates on the probability of giving colostrum were estimated using logistic regression. The probability of observing the set of covariates for subject i is $p_i = \exp(\boldsymbol{x_i'\beta})/[1+\exp(\boldsymbol{x_i'\beta})]$ (Agresti, 1990). Parameter estimates (β) were found by maximum likelihood.

Survival analysis was used to estimate the distribution of times to initiation of breast-feeding, as well as the effects of covariates on the time to initiation of breast-feeding. Empirically, times to initial breast-feeding appear to follow a negative exponential distribution (see Fig. 2). Therefore an underlying negative exponential probability density function, $f(t) = \lambda_i e^{-\lambda_i t_i}$, was assumed, where λ_i is the parameter of the exponential distribution and is a function of the covariates and underlying baseline hazard λ, as $\lambda_i = \lambda\exp(\boldsymbol{x_i'\beta})$. Maximum likelihood was used to estimate parameters λ and β.

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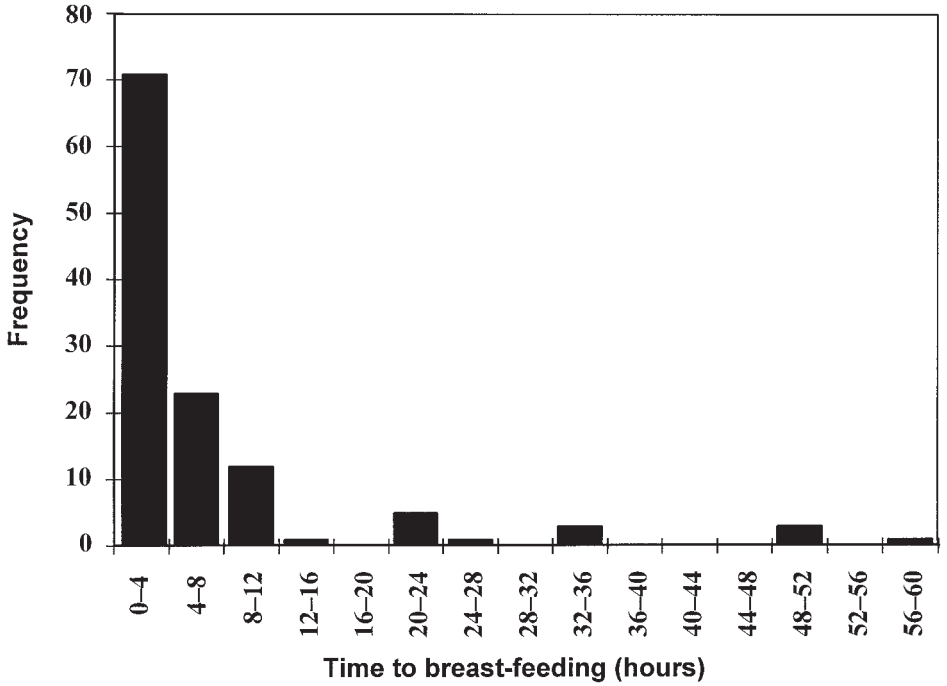

Fig. 2. Empirical distribution of times to first breast-feeding for 120 mother–infant pairs. The graph excludes three observations with times reported over 60 h and twenty interval-censored observations (see text).

Most mothers directly reported the number of hours until they first breast-fed their newborn, but some of the data collected on times to initial breast-feeding were incomplete from either right-censoring or interval-censoring. Excluding the incomplete observations or improperly treating censored observations as exact times leads to biased statistical estimates (Kalbfleisch & Prentice, 1980). Therefore, three likelihoods were derived, one for each type of observation, following Wood *et al.* (1992) and Holman & Jones (1998).

Exact times

Mother's reports of the number of hours until the first feed were collected at the first postpartum interview. The individual likelihood (L_i) of the i^{th} subject's exact observation of breast-feeding at time t_i is $L_i = \lambda_i e^{-\lambda_i t_i}$.

Interval-censored observations

These observations arose when a subject was not breast-feeding at her first postpartum interview, but was breast-feeding by the second postpartum interview. Because questions on hours to breast-feeding and colostrum feeding were only asked at the first interview following a birth, exact times to breast-feeding for these observations are not known. Rather, all that can be said about these observations is

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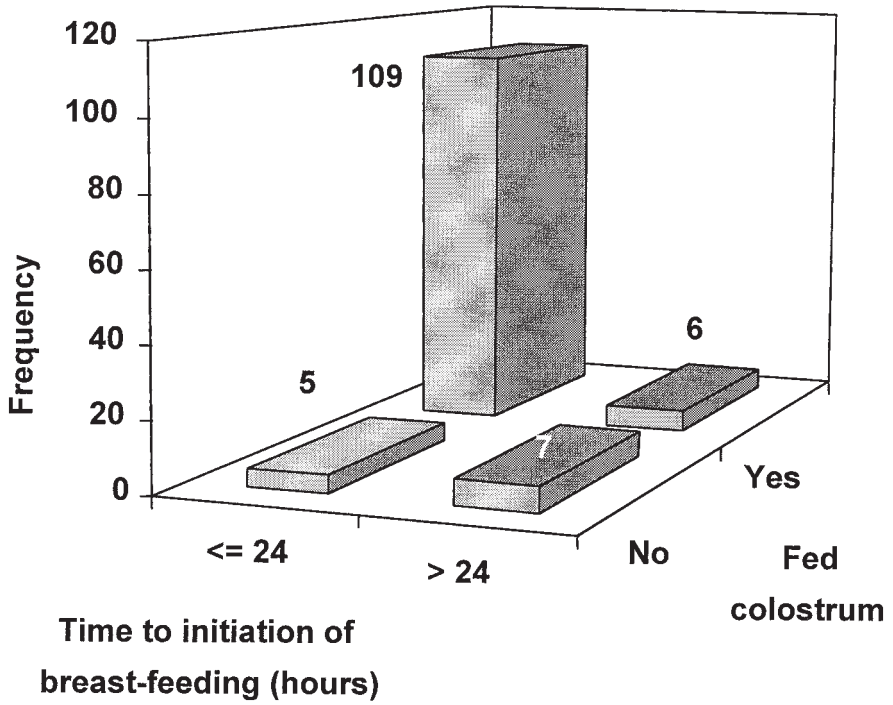

Fig. 3. Mothers who reported feeding their child colostrum and the time at which they initiated breast-feeding. This figure only includes 127 of the 143 women; sixteen women either did not respond to questions about colostrum feeding or could not be categorized as having initiated breast-feeding before or after 24 h.

that the subject began breast-feeding at some unknown time after the first interview (t_f) but sometime before the second interview (t_s). These observations are interval-censored around t_f and t_s, and the individual likelihood for the observations is $L_i = e^{-\lambda_i t_{f_i}} - e^{-\lambda_i t_{s_i}}$.

Right-censored observations

These observations arose when the subject was lost to follow-up at time t_c sometime after giving birth but before she began to breast-feed. The individual likelihood for these observations is $L_i = e^{-\lambda_i t_{c_i}}$.

A total likelihood is taken as the product of the individual likelihoods:

$$L = \prod_{i \in \text{exact}} (\lambda_i e^{-\lambda_i t_i}) \prod_{i \in \text{interval censored}} (e^{-\lambda_i t_{fi}} - e^{-\lambda_i t_{si}}) \prod_{i \in \text{right censored}} (e^{-\lambda_i t_{ci}}).$$

Parameter estimates are found as those that maximize this total likelihood.

Results

Out of 143 women, 130 mothers responded to the question on colostrum feeding. Of these, 117 (90%) reported feeding their child colostrum and thirteen said they did not

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Table 1. Parameter estimates for the best-fitting model of time to initiation of breast-feeding in a sample of 143 mothers, aged 18–48

Parameter[a]	Estimate[b]	SE	*z*
λ	0·2667	0·1062	2·51*
β_{age}	− 0·0320	0·0134	− 2·39*
β_{sex}	− 0·3363	0·0965	− 3·48**
$\beta_{complications}$	0·2244	0·1090	2·06*

[a]Sex was coded 1 for a male child; complications were coded 1 for yes.
[b]A negative coefficient is a reduction in the hazard, and implies an increase in time to initiation of breast-feeding.
*$p<0·05$; **$p<0·001$.

feed their child colostrum. Four per cent of mothers who said they did not feed their child colostrum still breast-fed within 24 h (Fig. 3). None of the covariates in the logistic regression was significantly associated with colostrum feeding behaviour (full model log likelihood, − 40·342; reduced model log likelihood, − 42·217; $\lambda^2 = 3·75$, 1 df, $p(\lambda^2 \geq 3·75) = 0·053$).

The empirical distribution of times to first breast-feeding is shown in Fig. 2. The observations of times to initial breast-feeding included 124 complete observations, seventeen interval-censored observations, and two right-censored observations. The survival analysis of time to initiation of breast-feeding yielded three variables as significantly associated with time to initiation of breast-feeding: maternal age, child's sex and delivery complications (Table 1). Younger mothers and those reporting delivery complications tended to initiate breast-feeding sooner, and girls were fed sooner than boys. Models that included the variables parity, history of pregnancy loss, and time from birth to interview were not a significant improvement over the reduced model by either a likelihood ratio test or by the standard errors of the parameter estimates. Figure 4 (top panel) shows the expected distribution of times to initiation of breast-feeding for mothers who did not experience delivery complications, stratified by two ages and child's sex, based on the parameter estimates given in Table 1. The lower panel shows the cumulative proportion of mothers expected to be breast-feeding by number of hours postpartum, stratified by these same variables. From the parameter estimates in Table 1, the associations among the three significant variables are shown in Fig. 5. The expected times to breast-feeding range from about 2 h for female infants of young mothers with delivery complications to 10 h for male infants of older mothers without delivery complications.

Discussion

In this sample colostrum feeding was nearly universal: 90% of all mothers reported feeding colostrum to their newborn. This finding could conceivably result from

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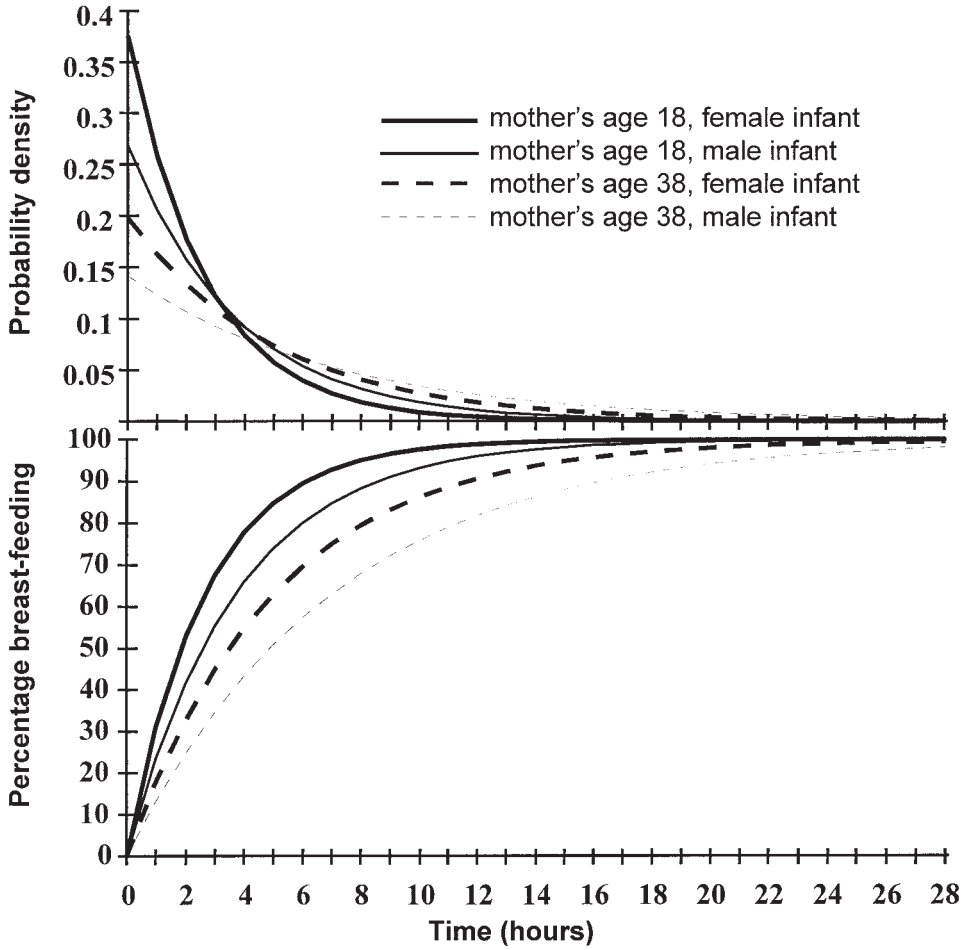

Fig. 4. Top panel is the distribution of times to first breast-feeding for mothers who did not experience delivery complications based on parameter estimates given in Table 1. The bottom panel is the cumulative distribution of breast-feeding mothers who did not experience delivery complications based on parameter estimates given in Table 1.

confusion on the part of the mothers about the definition of colostrum. Other studies suggest that colostrum is universally recognized by Bangladeshi women, even though they do not always know a specific name for it (Littler, 1997; Rizvi, 1993). Furthermore, only five mothers (4%) reported that they did not feed their child colostrum and yet reported breast-feeding within 24 h. (None of the five women was breast-feeding a previous child through the index pregnancy, which would have made their answers accurate.) By this measure, most women did not appear to be confused about colostrum.

Another potential source of confusion, as pointed out by Rizvi (1993), occurs when mothers are asked within a few days of delivery if they are feeding their child

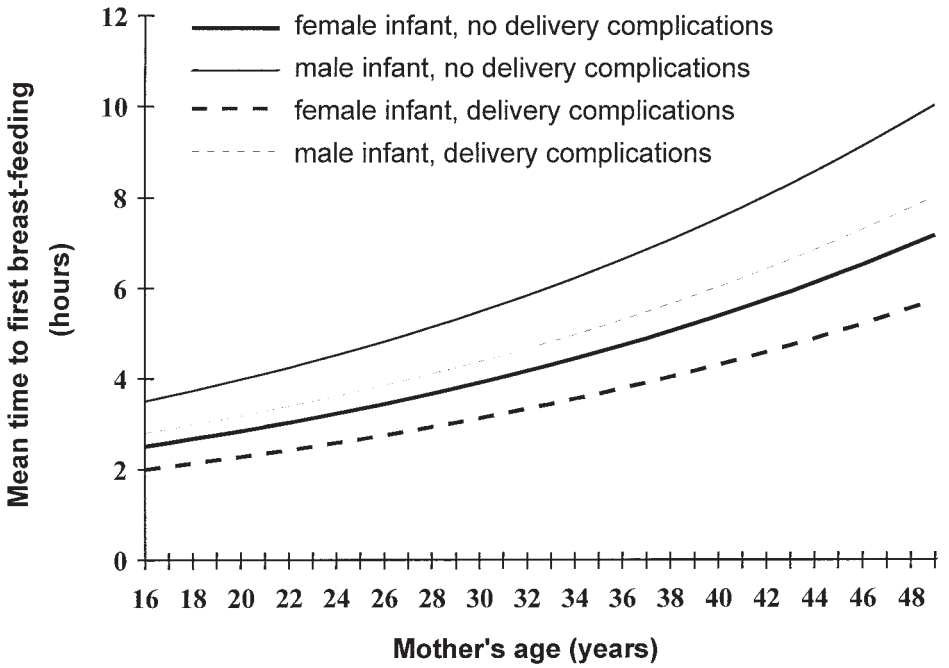

Fig. 5. Expected times to first breast-feeding by maternal age, sex of the child and whether or not the mother reported delivery complications, based on parameter estimates given in Table 1.

breast milk. Some Bangladeshi mothers do not consider colostrum to be breast milk, and might respond 'no' to such questions for a few days postpartum. In the present study confusion of this type was not apparent; only six of 127 mothers (5%) said they did not breast-feed for the first 24 h, but reported that they fed their child colostrum (Fig. 3). For those six mothers, it was not known if they were in error about their report, or whether they initiated breast-feeding after 24 h but while the breast milk was still primarily colostrum. Perhaps this overall consistency is a result of the particular wording of the question, which asked about taking the child to the breast rather than about breast milk *per se*.

The probability that a mother fed her infant colostrum was not affected by any of the covariates measured. This finding was surprising, because it was expected that older mothers would be less likely to feed their child colostrum. Even so, the nearly universal nature of colostrum feeding provides little statistical information to analyse factors affecting colostrum feeding.

In Matlab thana in 1993, 59% of mothers initiated breast-feeding within 4 h, 88% within 12 h, and 93% within 24 h of parturition. These percentages are much higher than those reported from earlier studies conducted in the Indian sub-continent. For a number of these studies the cumulative percentage of mothers breast-feeding within 24 h of parturition is reported or can be computed: Rizvi (1993) reported 22% for

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mothers from Tangail, Bangladesh, Banapaurmath *et al.* (1996) reported 29% for Indian mothers, Kumar, Nath & Reddaiah (1989) reported 19% for mothers in a south Delhi resettlement colony and Walia *et al.* (1987) reported 41% for urban mothers in Chandigarh, India, in 1984. Chowdhury *et al.* (1997) found from a Demographic and Health Survey (DHS) conducted in Bangladesh in 1993 and 1994 that 43% of women initiated breast-feeding within 6 h.

Two possibilities are suggested for the shorter times to breast-feeding found in the current study. First, women in the study were usually interviewed within a few days after giving birth, so that recall error was minimal, although Rizvi's study was also prospective. On the other hand, no statistically significant effect of the recall period on the timing to breast-feeding was found. The second possibility is that there have been substantial changes in breast-feeding behaviour in Bangladesh between 1982 and 1993. Interventions designed to promote colostrum and breast-feeding have been shown to be highly effective (Davies-Adetugbo, 1996; Akram, Agboatwalla & Shamshead, 1997; Tamagond, 1992; Nielson *et al.*, 1998). For several years before and during this study, there were a number of public health initiatives – billboards, television and radio announcements – designed to promote breast-feeding among Bangladeshi women (see Haider *et al.*, 1999). In the decade between Rizvi's study and this study, the frequency of initiating breast-feeding within 12 h seems to have increased drastically from 9% to 88%. Some of this difference may be explained by regional differences between Tangail and Matlab. Nevertheless, the magnitude of change suggests that substantial changes have occurred in breast-feeding behaviour in rural Bangladesh. This possibility is further bolstered by a recent report from a 1995 study of poor women in Dhaka, in which 99% of the mothers initiated breast-feeding within 3 days of delivery (Haider *et al.*, 1999).

This same trend can be seen for India where Walia *et al.* (1987) documented changes in breast-feeding initiation behaviour between 1974 and 1984. They found that the percentage of mothers initiating breast-feeding within 24 h has nearly doubled over a decade, and attribute this secular trend to an increased awareness of the mothers to the benefits of breast-feeding. The finding that younger mothers initiated breast-feeding sooner than older mothers is compatible with the idea that public health measures have been successful in promoting early breast-feeding, as younger mothers might be more receptive to these programmes. The lack of a significant association between mother's age and prevalence of colostrum feeding argues against this idea, but the overall high prevalence of colostrum feeding may leave too little variability to measure an effect of age on colostrum feeding.

Time to initiation of breast-feeding was affected by maternal age, the infant's sex and self-reported delivery complications. The relationships among these three variables, based on the parameter estimates in Table 1, are shown in Fig. 5. The mean time to initiation of breast-feeding for the oldest mothers is predicted to be about three times longer than for the youngest mothers. These differences are in the order of several hours, and may have little or no physiological or health significance. On the other hand, this delay may result in more children of older mothers receiving prelacteal feeds instead of colostrum, and hence experiencing a higher risk of diarrhoeal disease.

Of 143 mothers, 52 reported that they experienced delivery complications. In rural Bangladesh, deliveries almost always take place in private residences (either the subject's or her parent's house), with assistance from local midwives rather than trained medical personnel (Maloney, Aziz & Sarker, 1981, p. 175). For this reason, the term *complications* is not the same as that used by Western medical practitioners. Severe pain for 2 or more days was the most commonly described complication in this study. A less frequent complication was heavy bleeding, and some women reported unspecified complications. Mothers who reported delivery complications breast-fed their infant slightly, but significantly, earlier (Table 1). There are almost no studies in rural settings with home-delivered infants with which to compare this finding. Anecdotal findings in rural Bangladesh (Rizvi, 1993) and studies of hospital deliveries in developing countries (Hull *et al.*, 1990; Banapaurmath & Selvamuthukumarasamy, 1995) suggest that delivery complications usually delay initiation of breast-feeding.

Girls were breast-fed significantly earlier than boys, but the absolute differences in times were small. The median time to breast-feeding girls was about an hour before boys. Chowdhury *et al.* (1997) found that males were fed earlier than females in Bangladesh based on a large-scale DHS survey carried out in the same year as this study. The reasons for this discrepant result are unclear. The smaller sample size and limited geographic focus of the present study may preclude generalization about Bangladesh as a whole, and no additional information was collected to shed light on this finding.

Other studies from South Asia found no sex biases in initiation of breast-feeding. Banapurmath & Selvamuthukumarasamy (1995) found no effect of the child's sex on time to initiation of breast-feeding in hospital-delivered Indian infants, and Srivastava, Sharma & Kumar (1994) report that 93% of Indian mothers in their study would breast-feed males and females identically. The discrepancy found in Bangladesh might also be explained by methodological differences between this study and that of Chowdhury *et al.* (1997). Breast-feeding behaviour ascertained many months or years after parturition (as is the case in DHS surveys) may be subject to cultural biases that favour males, as suggested by Benakappa *et al.* (1989). Further research is necessary to test this idea, and for now it can only be speculated that the small absolute differences in initiation of breast-feeding might result from sex-specific differences in postpartum handling of the newborn for bathing, ceremony or religious practice.

The incomplete nature of some data used in the analysis of breast-feeding initiation necessitated the use of survival analysis. By doing so, statistical biases that result from dropping right-censored observations were eliminated, and underestimation of standard errors that occurs when interval-censored observations are treated as exact observations was prevented. The rather bimodal timing to first interview following a livebirth (Fig. 1) provided an opportunity to examine statistically the methodological concern of how the period of recall might affect a mother's response. The time from birth to the next interview was included as a covariate in both the logistic regression and the survival analysis. In neither case was the resulting coefficient statistically significant, suggesting that the period of recall did not affect the way in which mothers reported colostrum feeding or the time to initial breast-feeding.

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