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Breast-feeding and Return to Fertility: Clinical Evidence from Pakistan, Philippines and Thailand

Breast-feeding frequency alone is not a useful measure of breast-feeding stimulus in predicting the return of fertility (fecundity)

By Kathy I. Kennedy*

Breast-feeding is known to prevent women from becoming pregnant under certain circumstances. In recent years, reproductive physiologists have been studying the hypothalamic-pituitary-ovarian axis to learn more precisely how lactation postpones the return of "fertility," or fecundity. Family planning

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The frequency with which this young mother from one of Thailand's hill-tribes breast-feeds her baby may determine how soon she becomes fecund, and thus is an important fertility-regulating variable.

researchers are interested in knowing not only how breast-feeding inhibits ovulation, but how the return of fertility can be predicted during breast-feeding so that its natural contraceptive benefit can be relied upon with confidence.

"Fertility" in the lactating woman can be defined in various ways. Of course, a subsequent pregnancy during breast-feeding is considered definitive evidence of fertility. There are also various hormonal criteria for ovulation, and when sequential urine or serum samples are assayed for ovarian steroids and gonadotropins, a determination can be made about whether ovulation has occurred and whether progesterone production is sufficient to sustain a pregnancy.

In the absence of laboratory tests, the return of menses is a good proxy for the recovery of "fertility." Sometimes the first menses is preceded by ovulation and sometimes ovulation follows, but on balance, especially in large samples, menses can be considered a reasonable indication of fertility. It has been hypothesized that a woman's body requires some minimum amount of breast-feeding stimulus to suppress ovulation. The suckling of the baby exerts pressure on the nipple which creates a neural stimulus that is received at the hypothalamus. Two of the hypothalamic responses are increased beta endorphin secretion and decreased production of gonadotropin releasing hormone (GnRH), although the relationship between these two consequences is not clear. Exposed to little or no GnRH, the anterior pituitary is inhibited from secreting luteinizing hormone and accordingly, the ovary remains quiescent. Dopamine secretion is also inhibited by the suckling stimulus, to which the pituitary responds with increased prolactin production.

Prolactin and oxytocin (the pituitary hormones associated with milk production and the milk ejection reflex, respectively) are produced in peaks during episodes of breast-feeding. Prolactin gradually decreases to a basal level (albeit elevated above the norm for non-lactating women) until the next episode of breast-feeding, when the cycle repeats itself. Therefore, the basal level of prolactin is elevated when breast-feeding episodes are frequent. It is unknown whether prolactin returns a signal to the hypothalamus to suppress dopamine secretion, or whether prolactin plays a more direct role, inhibiting gonadotropin secretion or even ovarian activity (McNeilly, 1988, McNeilly, Glasier and Howie, 1985). Regardless of whether the production of prolactin (or oxytocin) is causally related to the suppression of fertility, the patterns of their production and secretion reflect the pulsatility of the neuro-endocrine stimulus produced by breast-feeding. This has led researchers to conclude that the frequency of breast-feeding episodes is an important characteristic of the breast-feeding stimulus, and accordingly, an important variable to measure.

It seems clear that the threshold of nipple stimulation (through breast-

feeding) that is required to inhibit ovulation is highly subject to individual variation. Women and their clinicians will testify that some mothers will not have menses and/or will be unable to conceive a desired pregnancy until after they have totally weaned the breast-feeding child. In such women, the inhibitory response to suckling is quite strong. In contrast, other mothers will ovulate, resulting in vaginal bleeding or conception, in response to relatively small decreases or even the absence of changes in suckling frequency (see table 1 section B). Indeed, even when the mother's hormone profile is known, it is difficult to predict when increasing levels of estrogen production will result in ovulation and the adequate luteinization required to maintain pregnancy.

Family Health International has undertaken several studies in Asia to better define the relationship between the breast-feeding stimulus and the return of fertility. At the outset, it was hoped that some aspect of breast-feeding behaviour could be found that would be observable to the breast-feeding mother and would also serve as an indicator of the end of natural infertility or the beginning of the resumption of pregnancy risk. Three prospective studies were conducted, and in all three, pregnancy and vaginal bleeding were the outcome variables indicative of fertility. In one study, in Bangkok, ovarian hormones were also measured so that ovulation could be detected. In all three studies, breast-feeding frequency was measured in an attempt to quantify the breast-feeding stimulus. This article provides an overview of the design and key findings of these studies and draws some conclusions about the reliability of breast-feeding as a "contraceptive."

Breast-feeding, menses and pregnancy in Pakistan

Pakistan's National Research Institute for Fertility Control conducted a longitudinal study of breast-feeding women in the city of Karachi (Khan *et al.*, 1989). Twenty-eight normal parturients who planned to breast-feed their babies and refrain from practising hormonal contraception were followed up weekly for one year, unless they became pregnant earlier. Senior female health visitors conducted the weekly home visits during which they asked the volunteers about the occurrence of any vaginal bleeding and the practice of contraception. The volunteers were given picture charts on which to mark the occurrence of each breast-feeding episode as well as the provision of infant supplements. Among the women studied, the average (median) time until the first post-partum bleeding episode (the proxy for fertility) was 4.6 months (mean = 5.9 months). The time of the first bleeding ranged from two to more than 12 months post-partum.

Table 1 section A shows the distribution of cases according to the time when the first vaginal bleeding occurred. The breast-feeding frequencies per day, per night and per 24-hour period are also given. When the volunteers are cate-

Table 1: Breast-feeding frequencies by time of first menses, pregnancy, or first ovulation

		N	Mean (range) of breast-feeding frequency		
			per day	per night	per 24 hours
A.	Month of first bleed (Karachi)*				
	1-3	9	6.2 (3-8)	3.9 (2-5)	10.1 (5-13)
	4-6	7	4.7 (2-7)	3.0 (1-5)	7.7 (3-11)
	7-9	5	6.8 (4-8)	3.6 (3-5)	10.4 (7-13)
	10-12	1	5.0 (5)	4.0 (4)	9.0 (9)
	Total	22	5.8 (2-8)	3.5 (1-5)	9.4 (3-13)
	No bleed; at conception (3½ months)	1	3.0 (3)	2.0 (2)	5.0 (5)
	No bleed; at termination (5 months)	1	6.0 (6)	3.0 (3)	9.0 (9)
	No bleed; at termination (≥ 1 year)	4	5.5 (3-8)	3.8 (2-5)	9.3 (5-13)
B.	Month of conception (Karachi)*				
	1-3	0			
	4-6	5	3.4 (1-5)	2.6 (1-4)	6.0 (2-9)
	7-9	5	5.6 (0-12)	2.8 (0-4)	8.4 (0-16)
	10-12	0			
	Total	10	4.5 (0-12)	2.7 (0-4)	7.2 (0-16)
C.	Month of first ovulation (Bangkok)**				
	1-3	4	6.3 (5-8)	4.0 (3-5)	10.3 (9-13)
	4-6	5	6.8 (3-9)	4.6 (3-6)	11.4 (6-15)
	7-9	7	4.7 (0-8)	2.9 (0-5)	7.6 (0-13)
	10-12	2	4.5 (2-7)	4.0 (3-5)	8.5 (5-12)
	>12	1	3.0 (3)	5.0 (5)	8.0 (8)
	Total	19	5.5 (0-9)	3.8 (0-6)	9.3 (0-15)

Sources: * Khan, Kennedy, Kazi and Steiner (1989).
** Israngkura, Kennedy, Leelapatana and Cohen (1989).

gorized according to the time of the first bleeding, as in this table, the mean values indicate that there is no appreciable difference in breast-feeding frequency between those whose amenorrhea ended early, midway through the year or late. No trend can be seen in the mean breast-feeding frequencies according to the duration of lactational amenorrhea. On average, the breast-feeding frequency of those with amenorrhea greater than one year in duration was the same (about nine episodes per 24 hours) as for those with amenorrhea of less than a year's duration.

The averages indicate that some uniform breast-feeding frequency – some uniform level of nipple stimulation – will result in the return of fertility in some women and in continued suppression of fertility in others. Yet if frequent breast-feeding produces surges in the pituitary hormone levels, then it would seem that some minimum frequency of breast-feeding should exist above which no woman will experience the recovery of fertility.

The ranges of breast-feeding frequency in table 1 section A indicate that in this small sample, no woman who breast-fed her child more than 13 times per day had menses. This finding could be tested in a larger number of Pakistani women. However, this minimum frequency of breast-feeding is actually quite high. For Western women who tend to have long breast-feeding episodes, i.e. 20-30 minutes apiece rather than short (5-7 minute) breast-feeding episodes, to breast-feed 14 times per day would have a paralysing effect on the mother's life. However, 14 *brief* episodes would be feasible, especially if the mother and baby were constantly together. The problem then becomes one of practicality.

Will a woman who is caring for children, doing household chores and often earning outside income have the interest, opportunity or discipline to tally her breast-feeding frequency to more than 13 episodes every day? Some early studies of breast-feeding and ovulation were able to define the minimum frequency of breast-feeding required to maintain anovulation as six. (McNeilly *et al.*, 1983; McNeilly *et al.*, 1985; Andersen and Schioler, 1982). These studies were among Scottish and Danish women for whom a breast-feeding episode takes a half hour, with suckling for comfort as much as for nourishment. Although European women do not necessarily have more time on their hands than women in Asia and the Pacific, if the breast-feeding score that one needed to reach was only six (albeit prolonged) feedings, then it might be more feasible to rely on a "magic number" to keep one's fertility from returning.

The ranges in table 1 section A underscore the other unwieldy characteristic of breast-feeding frequency as it relates to fertility, namely that the amount of breast-feeding stimulation required to postpone fertility varies widely. Menses returned in some women while they breast-fed their babies three times per day; in other women, the figure was 13 times per day. This means that many

women who breast-feed below the minimum threshold of 14 episodes may still enjoy natural protection, some of them for extended periods of time. So again, encouraging women to adhere to a minimum number of breast-feeding episodes per 24-hour period loses its appeal.

However, the naturalistic observations in table 1 section A do not necessarily negate the importance of frequent breast-feeding. Table 1 section B describes the subset of about a third of the women in table 1 section A who became pregnant while participating in the study. Since table 1 section A represents the initial potential recovery of fertility and table 1 section B represents definitive evidence of fertility, then the fact that breast-feeding frequency was lower at conception than at the end of amenorrhea reflects the relative influence of breast-feeding frequency on fertility. Generally speaking, for this group, ovarian activity began when the average breast-feeding frequency was nine, but full fertility was realized only after the average frequency was reduced by another 20-25 per cent to seven episodes.

Breast-feeding and ovulation in Thailand

A study conducted at the Pramongkutklao College of Medicine in Bangkok used the same study design as the Karachi study, but in addition to using the occurrence of vaginal bleeding or pregnancy as relative indicators of fertility, it measured the occurrence of ovulation (Israngkura *et al.*, 1989). To do this, each volunteer collected a 12-hour overnight urine sample once a week. The sample was assayed for pregnanediol-3-a-glucuronide, a metabolite of progesterone. Since progesterone is produced as a consequence of ovulation, only very low levels of pregnanediol are ordinarily detected unless a woman has ovulated.

In this study, when the amount of pregnanediol reached the lower limit of the range of pregnanediol produced after normal ovulation, then the volunteer was said to have ovulated. Ovulation is not positive proof that a woman is capable of subsequent pregnancy; for example, there may still be too little hormonal support for proper luteinization, resulting in what may appear to be normal menses. A study in Baltimore (United States) and Manila found that 41 per cent of first ovulations are characterized by abnormally low pregnanediol excretion (Gray *et al.*, 1990). Evidence of ovulation should, however, be considered a more precise marker of fertility than menses.

Table 1 section C displays information from the 19 mothers breast-feeding their babies in the Bangkok study arranged according to the month of the first post-partum *ovulation* (not *menses* as in table 1 section A of the Karachi study). Once again the large variation in breast-feeding frequency at the time of the fertility marker (ovulation) can be observed. One woman

first ovulated at a breast-feeding frequency of 15 episodes per day while another ovulated only after her baby was fully weaned.

There is a weak negative association between the duration of anovulation and breast-feeding frequency. However, this is the opposite of what one would expect if high frequency postpones fertility. More likely this is actually a reflection of the general gradual decrease in breast-feeding frequency as the children within this cohort grow older.

In sum, the Bangkok study concurs with the conclusions drawn from the Karachi study about breast-feeding frequency, but with the advantage of using a more precise measure of the dependent variable.

Breast-feeding education and return to menses in the Philippines

The studies in Karachi, Bangkok and Manila were attempts to measure the breast-feeding stimulus and the corresponding physiologic responses in order to learn how breast-feeding influences fertility. An experimental approach to learning about this relationship would involve manipulating the independent variable (breast-feeding) to determine if a change in the response (say, menses) could be induced. This experimental approach was taken in a study conducted through Silliman University in Dumagete, the Philippines (Savina and Kennedy, 1989). Two comparable rural communities were selected. One was designated as the experimental community and the other the control. In the experimental community, a breast-feeding education programme was conducted with the purpose of promoting more frequent and intensive breast-feeding, to postpone weaning and to confront local myths that are contrary to sound breast-feeding practices. Health educators established small classes among 5-10 pregnant women. The classes were held monthly in mothers' homes, and individual counselling was held monthly as well. No such special education about infant feeding occurred in the control group.

The data analysis showed that the mothers in both groups had their first vaginal bleed at the same rate (at about six months post-partum). In addition, as seen in table 2, until the sixth month post-partum, the mothers in both groups breast-fed their babies with the same frequency (i.e. 12-13 times per day). It was concluded that the rural women in the control group were already breast-feeding as frequently as was practical or possible. The education programme was associated with some major improvements in infant feeding behaviour, such as the feeding of colostrum, elimination of bottle use and the maintenance of high breast-feeding frequencies after solid food was introduced. Yet breast-feeding frequency could not be improved (increased) in the first five months post-partum in this rural population who were breast-feeding in a more or less traditional way.

Table 2: Mean breast-feeding frequency by education group and month post-partum

	Breast-feeding education group		Control group	
	Frequency	N	Frequency	N
Month post-partum				
1	14.4	60	14.4	45
2	13.9	55	12.8	57
3	13.4	61	13.1	64
4	13.0	53	12.5	51
5	12.4	62	11.3	56
6**	13.3	40	11.0	41
7*	13.3	35	10.9	33
8*	12.5	34	10.7	34
9	12.0	29	10.8	38
10	12.5	21	11.2	27
11**	14.2	21	10.3	27
12*	12.9	19	9.5	21

Source: Savina and Kennedy (1989).

Notes: * The difference between the groups is significant at $p < .05$.
** The difference between the groups is significant at $p < .01$.

These results do not refute the relationship between frequent and intensive breast-feeding and maximum protection from pregnancy. However, since a difference in breast-feeding frequency could not be created, neither does the study add experimental support to the premise. This study is currently being replicated in an urban area of the Philippines where there is more room for improvement in breast-feeding frequency.

Can breast-feeding be a reliable contraceptive?

The Asian studies described in this article are not the only ones to suggest that mothers should not depend on breast-feeding frequency alone as an index of protection from pregnancy (Elias *et al.*, 1986; Rivera *et al.*, 1988; Huffman *et al.*, 1987; Shaaban *et al.*, 1990; Gray *et al.*, 1990).

Ten years ago, the pioneering work on the return of ovulation prompted

the subsequent search for a frequency threshold, or an equation, or formula involving the breast-feeding stimulus that would characterize lactational infertility. Since the first studies suggested this pursuit, researchers have studied more diversity in breast-feeding behaviour, notably shorter episodes and longer durations of breast-feeding.

Larger numbers of subjects and varied locations on the globe also contributed to the relative diversity in human physiology that has now been seen.

None of these studies has yet adequately explained the diversity of responses to the breast-feeding stimulus. Some might argue that research has suffered from having too many different ways to quantify the breast-feeding variable. Indeed there are problems in defining nearly every aspect of breast-feeding, from what constitutes a breast-feeding episode to measuring the force of a baby's suck.[2] There are also other characteristics of breast-feeding that are relevant to the suppression of fertility, such as the length of the interval between feedings or the proportion of all feedings that are breast-feedings (Gray *et al.*, 1990).

Researchers are currently exploring these and other aspects of breast-feeding behaviour that could help to refine the measurement of this independent variable. The newer studies also involve larger numbers of women to permit multivariable analysis with more power than the studies presented in this article.

Yet it would be clearly naive to think that the difficulty in more successfully defining the relationship between breast-feeding and fertility is simply a measurement problem. There is some diversity in every aspect of human anatomy and physiology. An analogy can be made in the area of reproductive physiology: in one study of normally cycling (menstruating) women, the amount of estrogen produced during the mid-cycle peak was 207 pg/ml with a standard deviation of 6.1 (Shaaban *et al.*, 1987). The amount of hormone secreted as well as the ability of the end organ to receive it are subject to individual variation. It would appear that further basic studies of the neuroendocrinology of lactation are needed. Perhaps the use of modern, non-invasive techniques can be a useful substitute for the histologic studies that may currently be needed.

Despite relatively modest success in defining the breast-feeding correlates of infertility, a great deal has been learned along the way. For example, there is a new appreciation of the nature of the relationship between menses and ovulation. It is known that if women breast-feeding their babies have their first vaginal bleeding episode before the baby is six months old, then that bleed is very likely to foreshadow ovulation rather than result from it. However, after the sixth month, there is an increasing likelihood that ovulation will

precede the first menses, and accordingly, the risk of pregnancy during amenorrhea increases. For example, the Hopkins/Fabella study in Baltimore and Manila found that 45 per cent of "first bleeds" are anovular if they occur in the first six months post-partum vs. 20 per cent anovular after the sixth month (Gray *et al.*, 1990).

Another area of improved understanding concerns the relationship between supplementation and ovulation (or fertility). Early studies showed that supplemental feeding of the baby was so closely related to the onset of ovulation that it might actually cause ovulation, presumably by causing the breast-feeding stimulus (e.g. frequency or duration) to decrease. Such is generally the case when a mother replaces a breast-feeding episode with a feeding of infant formula or milk (Howie *et al.*, 1981). However, subsequent studies showed that supplemental feeding does not necessarily reduce breast-feeding, such as when the child is gradually given very small amounts of family foods. Accordingly, supplementation does not always lead directly or quickly to ovulation. These simple, newly appreciated phenomena have contributed to a recent consensus on the use of breast-feeding as a family planning method. Known as the "Bellagio Consensus," the following conclusion is based on a review of 13 studies in eight countries:

> Breast-feeding provides more than 98 per cent protection from pregnancy during the first six months post-partum if the mother is "fully" or nearly fully breast-feeding and has not experienced vaginal bleeding after the 56th day post-partum. (Family Health International, 1988; Kennedy, Rivera and McNeilly, 1989).

The Asian studies reviewed in this article contributed to the pool of data upon which the Bellagio guidelines are based. In theory, the Bellagio Consensus represents a practical way to time the introduction of contraception and to maximize the health benefits of breast-feeding for the growing child. Studies are currently underway to determine the efficacy of the guidelines in large numbers of women, and to determine whether the "method" is feasible for real women to use in the context of their busy lives.

Footnotes

1. Although duration of amenorrhea could not be increased in this experiment, the positive changes in infant feeding practices were associated with better infant health from months 2 to 7, even after controlling for maternal age and education.
2. Researchers from around the world recognize the problems associated with the measurement of breast-feeding. The Interagency Group for Action on Breastfeeding in 1989 issued a report by M. Labbok and K. Krasovec entitled *Breastfeeding Definitions*, which presents a simplified framework for the definition of breastfeeding behaviour. By using this framework, the comparability of research and the conclusions based upon research can be improved.

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