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Breast-Feeding and Post-Partum Amenorrhoea: An Indian Experience

Introduction

IT is extensively reported that breast-feeding is the major determinant of prolonged post-partum amenorrhoea (PPA), the time between a birth and resumption of the next menses, in societies where it is nearly universal, prolonged, and of high intensity (Santow, 1987; Howie and McNeilly, 1982; Habicht *et al.,* 1985; Akin *et a!.,* 1986; Huffman *et oil.,* 1987; Srinivasan *et a!.,* 1989; Savina and Kennedy, 1989; Nath *et cil.,* 1993; K. K. Singh *etal.,* 1994). Hence, in countries with prolonged breast-feeding, birth intervals are usually longer because of prolonged PPA. Both empirical estimates and simulations of birth interval dynamics suggest that in such countries, the contraceptive effect of breast-feeding is substantial. However, conditions under which breast-feeding can be used as safe and effective method of family planning are not well established. In a consensus statement (Anonymous, 1988), a group of international scientists agreed that the maximum birth spacing by way of breast-feeding is achieved when a mother fully or nearly fully breast-feeds and remains amenorrhoeic. Under such conditions, breast-feeding provides more than 98 percent protection from pregnancy in the first 6 months. The consensus statement calls for formulating guidelines for specific countries

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according to local infant-feeding practices and the average duration of PPA. Here, we analyze breast-feeding behaviour and duration of PPA prevalent in an Indian society.

Examination of the relationship between breast-feeding and PPA needs special techniques because women can change from a breast-feeding status to a nonbreast-feeding status during the study interval of PPA. Many authors have used proportional hazards models that take breast-feeding as a fixed covariate to study the effect of breast-feeding on PPA (Huffman *et ai,* 1987; Srinivasan *et al.* 1989). When the breast-feeding period is long, menses are likely to return while the mother is still breast-feeding. The duration of breast-feeding thus may exceed the duration of PPA. Hence, the results from taking breast-feeding as a fixed covariate may be biased because there is no effect of breast-feeding on PPA after resumption of menses (Habicht *et ai,* 1985; Guz and Hobcraft, 1991). Here, time-dependent multivariate hazards model has been used in which breast-feeding and its interactive variables are constructed properly in a time-dependent setting.

Reproductive physiologists have described the mechanism by which lactation inhibits reproduction. Suckling exerts pressure on the nipple, which creates a neural stimulus received at the hypothalamus. Hypothalamic responses are increased beta-endorphin secretion and decreased production of gonadotropm-releasing hormone; the anterior pituitary gland is inhibited from secreting luteinizing hormone and, accordingly, the ovary remains quiescent (Gordon et *al.,* 1987; McNeilly et at., 1985; Robyn et al., 1985).

Lactation may affect a woman's duration of PPA via the production of prolactin: frequent and intensive suckling results in the production of high levels of prolactin, which in turn inhibits ovulation (Lunn *et al.,* 1984). Nursing patterns may be associated with different plasma prolactin levels, which are associated with different lengths of lactational amenorrhoea (Diaz *et al.,* 1988).

Nutritional status may also have a direct effect on PPA (Lunn *et al.,* 1984; Diaz *et al.,* 1988). Many researchers have shown that several socio-economic, demographic, and cultural factors affect the length of PPA (Delgado *et al.,* 1982; Habicht *et al.,* 1985; S. N. Singh and Singh, 1989; S. N. Singh *et al.,* 1990; Nath *et al.,* 1993; K. K. Singh *et al.,* 1994). These factors are hypothesized to be the surrogate variables of the direct factors. However, the question of whether or not the effect of breast-feeding on PPA is same for all socio-economic groups has not been extensively examined in the literature. The interactive effect of breast-feeding duration and selected socio-economic factors are also considered in the present research.

Data and Methodology

The basic data used for this study come from a survey, 'Breast-Feeding and its Effect on Fertility', conducted in 1987 under the auspices of the Centre of Population Studies,

Banaras Hindu University, Varanasi, India, sponsored by the University Grants Commission, New Delhi. The main objective of the project was to study the pattern of breast-feeding and its effect on fertility. The study was based on data from two types of residential areas, 1100 urban and 900 rural households in Varanasi, a district of Eastern Uttar Pradesh. The urban households were selected from regions included in the urban area within the last 30 years.

In this connection several socio-cultural, economic, and other factors accounting for variation in duration of lactation and fertility were taken into account. In addition to other information, data were collected relating to age at marriage and childbirth, total number of children ever born and surviving, including details about duration variables— lactation, PPA, etc., for the last two births occurring within the last 7 years from the reference date (1 October, 1987) for each *eligible* woman in the household. A couple (or woman) was defined eligible if both partners were alive on the reference date and she was under age 50.

Data on length of breast-feeding and PPA were collected retrospectively. No data indicate how long infants were exclusively breast-fed nor is there any information concerning what proportion of the infant's total food was provided by breast milk and how this varied with time. Also, data do not provide information about maternal food supplementation or child's suckling habits. So, in this article, the duration of breastfeeding includes full as well as partial breast-feeding.

In our analysis, besides the influence of breast-feeding on the duration of PPA, variations in it due to caste, residence, education, age of the mother at the birth of the child, and her social status are also considered.

Caste has a socio-religious base. Caste beliefs exert a strong, stable, conditioning influence on human behaviour, social habits, customs, and practices. The segregated, caste-oriented living commonly practiced in villages reinforces caste beliefs and habits. Therefore, according to the proximity of social position, the sample has been subdivided into four broad groups. Hindus were divided into three groups as upper castes, middle castes, scheduled castes, whereas, Muslims forms a separate group. Women are classified into two residence groups: rural and urban.

Women's age at childbirth is known to be an important determinant of PPA. In countries such as India, where preference for male children exits, it is believed that the breast-feeding pattern depends on the infant's gender. Therefore, the roles of maternal age and child's gender on PPA are also examined.

Several factors affect household social status, which in India, particularly, in rural areas, is not only a function of caste and landholding but also life-style. Distinctive styles of life are determined through differences in household educational status, housing, etc. Rural household expenditures are not only determined by income but also by their inspiration for either maintaining their status or achieving upward social mobility. In this study, females are classified into three social-status groups: low, medium, and high

on the basis of the aggregated sum of scores which considers the following factors: (1) total household income, (2) household educational status, (3) housing, (4) landholding, and (5) possession of luxuries (for details, see K. Singh, 1990). It is expected that the individuals in high, medium, and low social status groups have respectively, better, average, and lower standards of living and correspondingly the food they consume also differs. Those in high social status group get highly nutritious food, and those in medium status group somehow manage to get a balanced diet. But persons in low status group are generally poorly nourished.

Because many women in the study were still breast-feeding and/or amenorrhoeic at the time of survey, life table techniques (Namboodiri and Suchindran, 1987) are used to examine the duration of breast-feeding and PPA. Life tables of the durations of breastfeeding and PPA are constructed, and summary measures such as median duration of breast-feeding and PPA and the percentage returning to menses up to fixed periods (3, 6, or, 12 months) are computed. Multivariate analysis of the duration of PPA is achieved through hazards modelling (Cox, 1972). Because of the time-dependent nature of the breast-feeding variable, special attention is paid to analyzing data on duration of breast-feeding and PPA. The breast-feeding variables are examined in two specifications. The first model specifies the hazard of the event 'return of menses' $[\lambda(/)]$ as follows:

$$\log \lambda(/) = \log \lambda o\,(t) + X\beta + \gamma\,\textbf{Breast}\,(t) \qquad (1)$$

where $\lambda 0\,(t)$ is a baseline hazard, X is a set of fixed covariates and Breast (t) is an indicator variable assuming the value 1 if the woman is breast-feeding t months after the birth of the child and 0 if she is not. The P and y are unknown regression coefficients. Note that the indicator variable Breast (t) simply examines whether or not breast-feeding status at a given time (current status) influences the return of menses at that time. Also by interacting the independent and Breast (/) variables, one can examine whether the effect of current status of breast-feeding on PPA varies among population subgroups defined by the variable. However, such specification of the breast-feeding variable does not account for the duration of breast-feeding, if it is stopped prior to the time at which the hazard is estimated. To include the duration of breast-feeding, the following specification of the model is used:

$$\log \lambda(/) = \log \lambda o\,(t) + X\beta + \gamma_1 D(t) + \gamma_2\,(XD(t)) \qquad (2)$$

where $D(t)$ equals minimum $(t,$ duration of breast-feeding). Note that for women who have stopped breast-feeding before t, $D(t)$ is the duration of breast-feeding and for those still continuing breast-feeding, obviously $D(t)$ is the time point of consideration. Such specifications avoid the problem of including breast-feeding duration longer than those of the duration of PPA. They γ_2 coefficients measure the interactive effects of the duration of breast-feeding with independent variables.

TABLE 1 : MEDIAN DURATION OF BREAST-FEEDING AND POST-PARTUM AMENORRHOEA (in months) AND PERCENTAGE OF FEMALES RETURNING TO MENSES BY A GIVEN MONTH BY SELECTED CHARACTERISTICS

	Median breast-feeding	*Median postpartum amenorrhoea*	*Percentage of females returning to menses up to*			
			3	*6*	*12*	*N*
Overall	26.39	9.40	38.21	45.72	72.69	1461
Household social status						
High	24.81*	6.31**	45.02	53.09	81.67	480
Medium	27.19	9.94	36.26	44.30	71.69	683
Low	28.57	12.43	31.66	37.10	60.53	298
Place of residence						
Rural	26.82	10.92*	38.31	45.72	72.79	703
Urban	25.96	8.35	38.12	47.02	76.57	778
Female's age at child birth						
<25 years	24.85	6.44**	43.01	52.77	78.67	659
2.5-"^9 years	^5.91	9.80	37.29	45.30	70.33	3TO
30-34 years	27.31	12.27	31.97	36.33	65.81	250
> 35 years	27.52	12.31	31.39	34.39	65.71	182
Child's sex						
Male	28.38	9.99	38.51	45.35	73.26	727
Female	24.96	9.32	37.89	46.06	72.13	734
Wife's education						
Illiterate or nominal	27.48**	10.98**	35.89	42.99	70.13	1103
Literate	24.48	4.33	49.38	59.04	85.27	358
Religion and Caste						
Muslim	24.86**	12.05**	36,10	43.43	67-07	243
Scheduled	28.45	11.56	27.92	37.69	68.90	246
Middle	27.46	9.55	38.48	44,78	72.98	*775*
Upper	24.24	2.37	58.59	69.69	87.10	197

*p <0.05. **p<0.01.

Results

Duration of Breast-feeding

Table 1 presents the median durations of total (full or partial) breast-feeding calculated from life tables for different population subgroups under study. The median duration of breast-feeding for the overall population is more than 2 years and each of the subpopulations exhibits similar medians.

However, there are some variations by various socio-economic and demographic subgroups. For example, a difference of about 4 month is observed between the median durations of breast-feeding relating to high- and low-social-status groups. The Wilcoxon

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25-29 years	25.91	9.80	37.29	45.30	70.33	370
30-34 years	27.31	12.27	31.97	36.33	65.81	250
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nonparametric test is used for group comparison. The differences in breast-feeding among the social-status groups are significant. The median durations of breast-feeding do not vary much according to mother's residence. There is some difference according to mother's age at the infant's birth. Mother's aged 30 and above at the child's birth have longer breast-feeding duration than those under 25. The median is about 3 months higher when the baby is male. Breast-feeding duration is higher among illiterates compared to that of literates and this difference is significant. The study population is predominantly Hindu, among whom caste status is often considered a strong indicator of socio-economic conditions (Srinivasan *et al.,* 1989). Scheduled castes, the poorest group, have the longest median duration of breast-feeding whereas Muslims and upper caste Hindus exhibit almost same duration. The differences among religion/caste composition are significant.

Duration of Post-partum Amenorrhoea

Table 1 also contains the median duration of PPA and the percentage of women returning to menses up to 3,6, and 12 months, computed from life tables. The overall median duration of PPA is between 9 and 10 months. Also, about one-third to three-fourths of women return to menses within the first 3 to 12 months after the birth.

The median duration of PPA differs significantly according to household social status. Its length for high status women is approximately half that of those of low status. About 45 and 80 percent respectively of women from the high status households return to menses in first 3 and 12 months; the corresponding percentages are about 30 and 60 respectively for low status women.

Urban women have relatively shorter durations of PPA. As the mother's age at birth increases, duration of PPA also increases and the difference among various groups are significant. Much variation is observed according to education. There is about a 15 percent difference between literate and illiterate women who return to menses within the first 3 months. Variation is also observed among different religion/caste groups which is significant. Muslims have the longest PPA period and upper-caste Hindus have the shortest. For upper-caste females, the median time for returning to menses is less than 3 months with about 60 percent completing the PPA period within the first 3 months;
corresponding figures for those in scheduled castes are 11.6 and 28.0.

Multivariate Analysis

Results obtained by fitting the model in equation (1) are shown in Table 2. After controlling for socio-economic and demographic factors, breast-feeding has significant influence on the rate of return of menses. The estimated regression coefficients for breast-feeding shows that at any point, the rate of return of menses becomes about 0.43 which is a reduction by 57 percent if the woman is breast-feeding at that time compared

TABLE 2: RESULTS FROM HAZARDS MODEL WITH CURRENT STATUS OF BREAST-FEEDING AS A TIME DEPENDENT CO-VARIABLE

Covanales	β	exp(β)	*S.E.*
Fixed co-variates			
Household social status[a]			
Low	-0.2649***	0.7673	0.0979
Medium	-0.1053	0.9000	0.0739
Rural Residence[b]	-0.1527**	0.8584	0.0726
Female 's age at child birth[c]			
< 25 years	0.3577***	1.4300	0.0979
25-29 years	0.1732*	1.1891	0.1040
30-34 years	-0.0307	0.9698	0.1126
Male Child[d]	-0.0412	0.9597	0.0606
Illiterate or nominal education[e]	-0.1371*	0.8719	0.0891
Religion and Caste[f]			
Muslim	-0.0961	0.9084	0.1370
Scheduled	-0.2038	0.8157	0.1316
Middle	-0.1664	0.8467	0.1102
Time dependent co-variates			
Breast-feeding[g]			
Yes	-0.8347***	0.4340	0.0948

Statistical significance: ***$p < 0.01$ **$p < 0.05$ *$p < 0.10$.

Omitted Categories: [a]high. [b]urban, [c]$\geq$ 35 years, [d] female, [e]literate, [f]upper, [g]no.

to the rate of women not breast-feeding at that time. Social status has a significant effect on the duration of PPA. Women with low social status have considerably lower rates of return of menses compared to those in the high status group. Also, younger women (< 25 years) have a significantly higher rate (1.4 times) of return of menses compared to that of women over 35. The rate of return does not vary by religion or child's gender.

The model specified by equation (1) was also used to test whether the effect of breast-feeding on the return of menses varies across diverse population subgroups. This test was accomplished by adding interaction terms of breast-feeding status and subgroup variables to the model. The results (not shown) demonstrated that none of the interaction terms were significant. The nonsignificance of the interaction terms indicates that the effect of current breast-feeding status does not vary across subpopulations; however, the main effects remain.

Results, from the model specifying breast-feeding duration and its interactive effect (equation 2) with selected socio-economic and demographic factors appear in Table 3. Since interactions of breast-feeding duration with socio-demographic variables other than residence, were not significant, only the interaction coefficient for breast-feeding and residence is given.

Table 3: RESULTS FROM HAZARDS MODEL WITH DURATION OF BREAST-FEEDING (BF) AS A TIME DEPENDENT CO-VARIABLE

Covariates	*β*	exp(β)	*S.E.*
Fixed co-variates			
Household social status[a]			
Low	-0.2837*** -	0.7530	0.0981
Medium	0.1089	0.8968	0.0740
Rural residence[b]	-0.0847	1.0844	0.0968
Female 's age at child birth[c]			
< *25* years	0.3103***	1.3639	0.0968
25-29 years 3	0.1689	1.1840	0.1011
0-34 years	-0.0705	0.9319	0.1126
Male Child[1d]	-0.0528	0.9486	0.0892
illiterate or nominal education[e]	-0.1565*	0.8551	0.0914
Religion and Caste[f]			
Muslim	-0.1450	0.8651	0.1365
Scheduled Middle	-0.2330	0.7922	0,1313
	-0,2043	0.8152	0.1102
Time dependent co-variates			
BF Duration	-0.0546***	0.9469	0.0139
Rural*BF duration	-0.0317***	0.9688	0.0084

Statistical significance: ***$p < 0.01$ **$p < 0.05$ *$p < 0.10$

Omitted Categories: [a]high. [b] urban. [c] ≤35 years, [d]female, [e]literate, [f]upper.

An examination of the regression coefficient in Table 3 shows that women's social status and age play a significant role in the variation of the duration of PPA. However, among urban women, the rate of return of menses is reduced by 5 percent for every additional month of breast-feeding, while the reduction rate is 8 percent for rural mothers. Thus, for an urban woman breast-feeding for 6 months, the relative risk of return of menses is 0.72 [exp (-0.0546 x 6)] and the corresponding risk for those in rural areas is 0.59.

Discussion

Though the association between breast-feeding and resumption of menses is our main focus, variations in the duration of PPA due to caste, residence, education, and age of the woman at the birth of the child and her social status are also examined. The present study reveals that duration of breast-feeding is more than 2 years in every population subgroup and the variations due to social status, caste, and education are significant. In this connection, it is worthwhile to point out that the duration corresponds

to total (full or partial) breast-feeding and there is no information about the frequency and duration of suckling practices or supplementation of food to lactating women.

The overall median duration of PPA is between 9 and 10 months. Thus, the period of PPA is on average 17 months shorter than that of breast-feeding. This finding is consistent with those of other studies (Huffman *et al.,* 1987; Srinivasan *et al.,* 1989; Jones, 1990; Nath *et al.,* 1993). Here, we note a similarity between lower class living conditions in European countries in the 19th century and in developing countries today. A Norwegian study (Liestol *et al.,* 1988) based on 19th-century data also supports this comparison.

Results show a very significant effect of social status on PPA. Obviously, during pregnancy and lactation, the mother needs a balanced diet based on a variety of nutritious food items. Some mothers, especially poorly nourished ones, need to eat more during the last months of pregnancy. As pointed out earlier, high status women get highly nutritious food, and those in medium-social-status groups somehow manage to get a balanced diet for a while, especially after delivery. But, mothers in the low-social-status group are, in general, poorly nourished and seldom get supplementary food even during pregnancy and afterwards. Others (Prema *et al.,* 1981; Huffman *et al.,* 1987; Ramchandran, 1987) have documented that maternal health effects PPA. A number of studies worldwide suggest that poor nutritional status diminishes the volume and the fat and vitamin content of breast milk (Geissler *et al.,* 1978; Jelliffe and Jelliffe, 1978) and might produce hungrier infants who suckle more frequently and more intensively, thus lengthening PPA (Thapa *et al.,* 1988; Kennedy *et al.,* 1989). On the other hand some studies has shown that supplementation to lactating women has no effect on the maternal milk output (Lunn *et al.,* 1981). There is evidence that nutritious food improves the health of the mother which accelerates the return of menstruation and shortens the duration of PPA (Frisch, 1983). Also, the return of menstruation and fertility occurs more rapidly in the economically advantaged segment of developing countries (McCann *et al.,* 1981; Ramchandran, 1987).

Table reveals that the maternal age at child birth has significant effect on the duration of PPA. Other studies show that increased maternal age is associated with longer duration of PPA (Huffman *etal.,* 1987; Jones, 1990), possibly reflecting a biological delay in hormonal mechanisms responsible for ovulation (Wood, 1989). Mother's education is negatively associated with the duration of PPA, consistent with other studies (Huffman *et al.,* 1987; Nath *et al.,* 1993; K. K. Singh *et al.,* 1993, 1994). The result is partly supported by findings that greater maternal education is associated with earlier introduction of supplementary feeding as well as an increased likelihood of first giving a liquid supplement, which would likely lessen suckling.

Application of the models given in equations (1) and (2) shows that there is significant reduction in the return of menstruation due to breast-feeding. Other have also obtained similar results, for example, Habicht *et al.*. (1985) have shown that a month

of full breast-feeding prolongs amenorrhoea, and even partial breast-feeding has a strong prolonging effect. Also, suckling frequency and the duration of the longest period of suckling activity have sometimes been used as a measure of the amount of breastfeeding. However, because of lack of information (such as, full/partial breast-feeding, suckling frequency, etc.) in our data, it is not possible to examine the mechanism in detail as studied by others.

There is no interaction effect of breast-feeding, defined by its current status, in the population subgroups. However, when the interactive effect is re-examined, taking into account breast-feeding duration, significant interaction with maternal residence is obtained. The model given by equation (1) suggests that the rate of return of menses for rural women females is lower than that for urban women. However, the model in equation (2) suggest that the rate of return of menses is almost the same when no breast-feeding is involved, but urban women return to menses faster than rural women if they are breastfeeding. Ramchandran (1987) also found that rural women have longer duration of PPA.

In general, our study shows that the return of menses is delayed to some extent by breast-feeding. However, it is important to point out that there is substantial variation in duration of PPA among population subgroups despite nearly universal breast-feeding. Thus, further examination with detailed information is necessary to assess the effect of breast-feeding on the duration of PPA.

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