Relationship Between Breastfeeding and Postpartum Amenorrhea among Indian Women: An Epidemiological Appraisal

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Abstract: There has been renewed interest about what the optimal duration of postpartum amenorrhea (PPA) so that women should know in advance to use contraceptives and prevent unwanted births. The main objective of the present study (using National Family Health Survey (NFHS)-3 data) is to ascertain the duration of breast-feeding which will yield optimal contraceptive effect, that is, after how many months of breast-feeding; its effect on PPA has appeared/disappeared in the Indian setting. After adjusting the important confounding factors, no significant effect of breast-feeding was found up to the 10th month in extending the return of ovulation after delivery. Further, we have tried to determine after how many months of breast-feeding the role in extending PPA has disappeared. After retaining the important covariates at their average level and then changing the duration of breast-feeding from 6-10 months to 11-14 months, the gain in the duration of amenorrhea was around 1.3 months. Again, by changing the duration of breast-feeding from 11-14 months to more than 15 months, the gain in extending the duration was significant and was around 1.6 months.

Key words: Postpartum amenorrhea · Ovulation · Postpartum anovulation · NFHS-3 · India

INTRODUCTION

It has long been established clinically as well as empirically (based on demographic data) that breast-feeding postpones the return of ovulation after birth; it lengthens the period of postpartum anovulation, during which a woman cannot conceive. It also extends the return of menstruation after birth-postpartum amenorrhea (PPA).

However, the occurrence of ovulation precedes menstruation by around nine days [1] and generally, it happens within the first six months after delivery. At times, first postpartum menstruation precedes ovulation; these are called anovulatory menstruations and are more likely to be occur after six months of delivery. Moreover, the duration of amenorrhea could be extended and it highly depends upon the nature of breast-feeding. So, the relationship between duration of postpartum anovulation and amenorrhea are not perfectly related [2].

In demographic literature the PPA period is defined as the time interval between a birth and resumption of the next menstruation and this definition is generally used in collecting large scale data in demographic and health surveys. It is expected that reporting of the PPA period would be better than reporting of the duration of postpartum anovulation because women can easily observe menstruation. Therefore, in demographic literature PPA period is used as a proxy for the duration of postpartum anovulation.

Some women may not have sound knowledge about duration of postpartum bleeding (known as lochia) and find it difficult in differentiating it from resumption of menstruation. Chances are high to gather inaccurate information in case of late postpartum bleeding in a cross-sectional survey. Moreover, the probability of getting accurate information from illiterate women will be further lowered. However, its accurate reporting is very much expected by demographers and epidemiologists who use postpartum resumption of menstruation as a proxy for breast-feeding intensity and the return to fecundity.

Previous investigations of PPA in developing countries suggest that the distribution of amenorrhea is bimodal composed of a "normal" duration subgroup and a short duration subgroup that resumes menses within 3 or 4 months [3-4]. It is this short-duration subgroup that has puzzled demographers/epidemiologists. Some

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investigators viewed that the short duration subgroup arises as an artifact of data collection errors. One such error is the misclassification of late postpartum bleeding as resumption of menses [5-6].

The mechanism through which breast-feeding affects the population growth is by increasing the postpartum amenorrhea period and this relationship is also well supported by clinical evidence. A number of physiologists have tried to explain the reasons how breast-feeding influences PPA. Sucking of the nipple by infants exerts pressure, which further sends a neural signal to the hypothalamus, a nerve center in the brain. Hypothalamus signals the pituitary gland to increase the production of the hormone prolactin. Prolactin inhibits ovulation either by reducing the release of gonadotropic hormones needed for ovulation or by directly affecting the ovaries.

The duration as well as nature of breast-feeding are the major determinants of prolonged PPA and are well documented in both aggregative and individual level analyses. This phenomenon has been verified by eminent researchers [7-14]. Further, prolonged PPA works as a catalyst in increasing the birth interval. Many studies have found the contraceptive effect of breast-feeding, especially regarding the circumstances when it becomes more effective and safe. But, contraceptive role of breast-feeding is not fully established. In a consensus statement, a group of international societies put forward the view that when mothers breastfeed exclusively or near to that, there is higher chance that a woman remains under amenorrhea period. Under such conditions, almost 95 percent women are protected against pregnancy [15].

A careful examination is required when one tries to examine the relationship between breast-feeding and PPA in a cross-sectional setting. There may be a chance that at the time of survey some women might have continued to breastfeed after resumption of the menstrual period. The application of proportional hazard models taking breast-feeding as a fixed covariate is evident in the literature [16], but there is a strong argument that taking breast-feeding as a fixed covariate may be biased because there is no effect of breast-feeding on PPA after resumption of menstruation. Hence, it is suggested that a time-dependent multivariate hazard model be used and consider breast-feeding variables in a time-dependent setting [17]. There are also studies which have tried to determine the impact of breast-feeding on birth interval, but they are mainly based on the assumption that there is no effect of breast-feeding beyond resumption of menstruation. Such studies underestimate the effect of

breast-feeding because there is empirical evidence that the continuation of breast-feeding beyond the resumption of menstruation suppresses the probability of conception. In some societies breast-feeding is associated with postpartum abstinence, which, if continued beyond the resumption of ovulation, will affect the length of the birth interval, independent of the physiological effects of breast-feeding.

There was a strong and persistent reduction in chances of conception for lactating women who have resumed menstruation. Using world fertility survey data, it has been concluded with the help of life table techniques and stochastic analysis that continued breast-feeding beyond resumption of menstruation inhibits fertility [18]. Further, it is also found that breast-feeding after resumption of menstruation reduced the rate of conception by 47 percent (adjusted) [19]. In a similar manner, it is also added to this topic that longer birth intervals have been found among those Indian women who breastfed beyond resumption of menstruation [20]. But, in the Indian situation there are few studies based on large-scale data where it has been shown that there is an effect of breast-feeding on the birth interval after resumption of menses. The main objective of the present study is to ascertain the duration of breast-feeding which will yield optimal contraceptive effect, that is, after how many months of breast-feeding its effect on PPA has appeared/disappeared in the Indian setting. It is well documented that duration of breast-feeding has a positive impact on the duration of postpartum amenorrhea across different settings [21-25]. Further, the result shows that changes in breast-feeding behavior during 6 to 18 months after child birth affect the duration of PPA [9]. During the period of PPA the chances of conception are considered virtually nil. However, this period is not totally safe. Therefore, it is appropriate to determine the contraceptive role of breast-feeding using recent National Family Health Survey-3 (NFHS-3) data set.

MATERIALS AND METHODS

This study banks on secondary data collected by National Family Health Survey, conducted in India during 2005-06.

The information related to breastfeeding, amenorrhea and abstinence was collected only for births since 1st January 2000-01 in NFHS-3, so women who had last but one child are included in the analysis. If the displacements of birth occur, they are excluded from the analysis. Postpartum abstinence from sexual intercourse is defined

only after occurrence of first birth. Therefore, the interval between marriage and the first birth has also been excluded from the analysis. So, the period of interest in our study is that between the dates of birth marking the start of the interval and either the date of next conception, or the interview date (if no conception occurred before then). In effect, we have covered two types of birth intervals- open and closed birth intervals. Closed birth interval (CBI) is the defined as the time period between the dates of occurrence of birth to the next birth, whereas open birth interval (OBI) is birth to date of interview. There are a number of advantages of OBI over CBI. Open birth interval (OBI) is concerned only with the date of birth of the last child hence non-sampling errors like recall lapse, interviewer bias etc. may be less prevalent than in CBI [26]. But, sometimes a closed birth interval is counted as an open one due to misreporting. It is possible that at the time of interview a woman does not know that she is pregnant. So, if she is pregnant the birth interval is wrongly computed. Including these intervals will result in pregnancy rates to be biased downwards, because a pregnancy may not be recognized or reported until two or three months after conception.

It is well understood that breast-feeding is positively correlated with birth spacing and both have an impact on the chances of survival of children or child health. Such a study faces the problems of spuriousness and simultaneity. In some situations a child's health status may affect feeding practices. For example, among newborn, some may be too weak to suckle even though they live long enough. For such children, poor health at birth may lead to never being breastfed, again creating a negative association between breast-feeding and PPA. Similarly, for those who do initiate breast-feeding, illness may lead both to early weaning and to death. Such types of situations create spurious relations between the variables.

Simultaneity biases also arise in the data because generally it happens that whenever couples attempt to replace a lost (index) child it generates a shorter interval. So, the resulting shorter interval is the consequence and not the cause of the survival status of the index child. Obviously, the length of the interval is an endogenous variable. It is also found in the literature that bias can also arise if women curtailed breastfeeding because of access to better medical care facilities [27].

The heaping of duration of breastfeeding occurs simultaneously with heaping of the duration of age at death and could lead to a serious underestimate of the beneficial influence of breastfeeding. There are two possible solutions first, it is well known that classification of the duration in such a way that boundaries do not coincide with any preferred digit. The other solution is to control heaping by introducing a new variable, which indicates whether or not the reported breastfeeding duration coincides with an 'attractive' digit. We attempted both ways and preferred the first one (Figure 1).
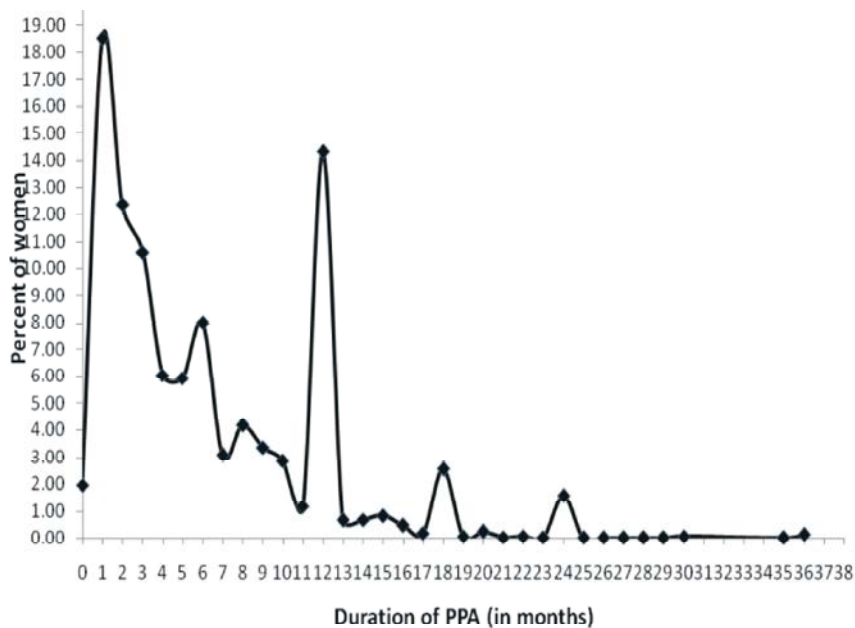

Fig. 1: Percent of women by duration of PPA-NFHS-3

RESULTS

Description of Data: Table 1 shows socio-economic, demographic and breast-feeding status of women who had last but one child for India during the year 2005-06. The table clearly indicates that around eight percent women had never gone for breast-feeding and about 10 percent women continued breast-feeding only for 5 months or less. However, around 48 percent women preferred to breast-feed for more than 14 months. It is also observed that less than one forth women were breast-feeding for 11 to 14 months compared with only 12 percent women who breast-fed for 6-10 months.

More than one-third women belonged to central region and slightly less than one-fourth women were residents of the eastern region. However, around 13 percent women hailed from the north and also nearly same proportion was from the south. About three and 12 percent ever-married women who had last but one child surveyed were from the northeast and western regions respectively. The highest percentage of women came from rural areas and about less than one-fourth women had their residence in the urban areas. A majority (around 77 percent) of women were Hindus. The percentage of Muslim women was around 18. Around 55 percent women had no education. The distribution of women by wealth index shows that about 52 percent women were in the lowest two-wealth quintiles compared to around 28 percent who were in the top two-wealth quintiles. The percentage of female children was found to be more in the sample as compared to male children. Around 10 percent women who had last but one child had experienced the death of the index child. The age distribution of women shows that about 29 percent women were below 20 years of age compared to nine percent women who were more than 29 years old at the time of birth of index child. Around 44 and 18 percent women were in 20-24 and 25-29 age-groups at the time of birth of index child, respectively. The proportion of women who were at parity one was around 40 percent. More than one-fifth women were at parity two and also the same proportion of women was found to be at parity four or above. The lowest percentage of women was at parity three. The proportion of mal-nourished mothers was found to be around 39 percent in the sample and about four percent mothers were not having information of body mass index.

Table 1: Socioeconomic, demographic and breast-feeding status of women who had last but one child for total sample of women for India, 2005-06.

Variables	Percent	Sample Size
Duration of breast-feeding (in months)		
Never breastfed	7.6	908
0-5	9.7	1095
6-10	12.2	1509
10-14	22.4	2576
>=15	48.1	5182
Region of residence		
North	12.7	1835
Central	34.7	3234
East	24.5	1741
Northeast	3.0	1963
West	12.0	1117
South	13.1	1380
Place of residence		
Rural	77.6	7439
Urban	22.4	3831
Religion		
Hindu	77.2	7542
Muslim	18.4	2074
Others	4.4	1654
Mother's education		
Illiterate	55.1	5214
Literate	44.9	6056
Standard of living		
Poorest	28.4	2336
Poorer	23.6	2283
Middle	20.3	2461
Richer	17.5	2440
Richest	10.2	1750
Sex of child		
Female	51.3	5786
Male	48.7	5484
Survival status of child		
Dead	10.3	1044
Alive	89.7	10226
Mother's age at birth (yrs)		
< 20	29.4	2888
20-24	43.6	5001
25-29	18.2	2316
>=30	8.8	1065
Parity		
1	40.2	4800
2	23.5	2654
3	13.5	1535
>=4	22.8	2281
Maternal BMI		
<18.5Kg/m2	39.3	3792
>=18.5Kg/m2	56.8	7037
Missing	3.9	441
Total	100.0	11270

Impact of Duration of Breast-feeding on Postpartum Amenorrhea (PPA): Duration of breast-feeding (in months) has been cross-classified with duration of PPA (in months) including never breastfed category of mothers and the results are presented in the Table 2. The main idea behind such an analysis is to compare the different sets of grouped data on months of breast-feeding with women who never breastfed by different sets of grouped data of PPA.

In this way, we intend to estimate the impact of breast-feeding on PPA. Table 2 indicates that more than 65 percent mothers who had less than 11 months of breast-feeding or those who never breastfed were having 0-5 months of PPA. Z-test clearly indicates that the proportion of mothers between those who had 0-5 months (or 6-10 months) of breast-feeding and those mothers who never breastfed were not having any significant difference in relation to duration of PPA. However, it was also found that a significantly higher proportion of mothers who had 0-5 months of breast-feeding belonged to 0-5 months of PPA than never breast-fed mothers. Breast-feeding beyond 10 months had a significant impact on the mean duration of amenorrhea than non-breast-feeding women. It can be concluded from this analysis that breast-feeding of 10-14 months duration may postpone PPA, but beyond 14 months its contraceptive role may not be strong enough to protect pregnancy.

Adjusted Mean Duration of Postpartum Amenorrhea (PPA): An attempt has been made to adjust all the important confounders and we have tried to compare

them with unadjusted results. The adjusted mean duration of PPA (in months) of those women who had last but one child by selected characteristics is presented in Table 3. As duration of breast-feeding increases, the adjusted mean duration of amenorrhea also increases significantly. This may be true after 10 months of breast-feeding.

However, the adjusted mean duration of amenorrhea among those women who never breast-fed was significantly longer than those women who breast-fed for 10 months or less. After 10 months of breast-feeding, the mean duration of amenorrhea was significantly longer than among non breast-feeding women. Again, it supports the argument that breast-feeding up to 10 months has no role in delaying amenorrhea. The difference in the mean duration of amenorrhea between mothers who never breast-fed and those breast-feeding for 11-14 months was less than one month and it was more than two months for those women who were breast-feeding for more than 14 months. This clearly indicates that breast-feeding after 14 months has a significant impact on PPA. This finding is in contrast to our earlier finding and supports the argument that breast-feeding beyond 14 months has a significant role in delaying amenorrhea. But, we were unable to find the upper value of the duration of breast-feeding when its impact disappears.

As evident from the table, the mean duration of PPA among those women who had last but one child ranges from 5.7 months for women in the northern region to 6.7 for women in the western region. The difference was found to be statistically significant. The difference in

Table 2: Percentage distribution of women who had last but one child according to their duration of breastfeeding (in months) and duration of amenorrhea (in months) for total sample of women for India-2005-06.

| Duration of amenorrhea (in months) | Never breastfed (1) | Duration of breast-feeding (in months) | | | | Z_{12} | Z_{13} | Z_{14} | Z_{15} | Z_{23} | Z_{24} | Z_{25} | Z_{34} | Z_{35} | Z_{45} |
		0-5 (2)	6-10 (3)	11-14 (4)	$\geq$ 15 (5)										
0-5	69.0	78.9	66.3	51.5	41.9	4.4^{12}	0.5	7.0^{14}	11.1^{15}	4.5^{23}	12.6^{24}	17.6^{25}	8.8^{34}	14.1^{35}	4.9^{45}
6-10	13.8	11.6	22.8	25.2	21.3	0.8	1.3	2.6^{14}	1.8	2.2^{23}	3.5^{24}	2.7^{25}	1.7	0.6	1.7
11-14	12.8	8.2	8.0	20.2	23.9	1.1	1.4	1.6	2.6^{15}	0.1	2.6^{24}	3.3^{25}	3.1^{34}	3.8^{35}	1.8
>=15	4.4	1.3	3.0	3.1	12.9	0.4	0.2	0.03	1.4	0.2	0.4	1.2	0.3	1.7	2.4^{45}
Total	100.0 (908)	100.0 (1095)	100.0 (1509)	100.0 (2576)	100.0 (5182)	-	-	-	-	-	-	-	-	-	-

Note: Percentages are based on weighted data and sample sizes are unweighted. Z-test has been calculated based on unweighted data.
[12]Significantly different between never breastfed and breastfeeding 0-5 months, P<=0.05 (Proportion Z-test, two-tailed).
[14]Significantly different between never breastfed and breastfeeding 11-14 months, P<=0.05 (Proportion Z-test, two-tailed).
[15]Significantly different between never breastfed and breastfeeding >=15 months, P<=0.05 (Proportion Z-test, two-tailed).
[23]Significantly different between breastfeeding 0-5 months and 6-10 months, P<=0.05 (Proportion Z-test, two-tailed).
[24]Significantly different between breastfeeding 0-5 months and 11-14 months, P<=0.05 (Proportion Z-test, two-tailed).
[25]Significantly different between breastfeeding 0-5 months and >=15 months, P<=0.05 (Proportion Z-test, two-tailed).
[34]Significantly different between breastfeeding 6-10 months and 11-14 months, P<=0.05 (Proportion Z-test, two-tailed).
[35]Significantly different between breastfeeding 6-10 months and >=15 months, P<=0.05 (Proportion Z-test, two-tailed).
[45]Significantly different between breastfeeding 11-14 months and >=15 months, P<=0.05 (Proportion Z-test, two-tailed).

Table 3: Adjusted mean duration of amenorrhea (in month) of women who had last but one child by selected characteristics for total sample of women for India-2005-06.

Variables	Mean duration of amenorrhea	95% CI Lower	95% CI Upper
Duration of breast-feeding (in month)			
Never breastfed	5.06a	2.78	7.34
0-5	4.11b	1.39	6.83
6-10	4.56c	1.85	7.27
11-14	5.83d	3.15	8.51
>=15	7.45e	4.80	10.11
Region of residence			
North	5.67a	3.3	8.03
Central	6.06b†	3.41	8.72
East	6.25b	3.55	8.96
Northeast	6.22b	3.48	8.95
West	6.72c‡	3.98	9.45
South	6.55b†‡	3.83	9.27
Place of residence			
Rural	6.25	3.68	8.81
Urban	6.05²	3.25	8.85
Religion			
Hindu	6.26a	3.72	8.81
Muslim	5.88b	3.09	8.68
Others	6.16*	3.27	9.05
Mother's education			
Illiterate	6.16	3.64	8.69
Literate	6.19	3.44	8.94
Standard of living			
Poorest	7.33a	4.94	9.71
Poorer	6.60b	3.93	9.28
Middle	6.26c	3.57	8.95
Richer	5.48d	2.76	8.2
Richest	4.95e	2.16	7.73
Sex of child			
Female	6.13	3.57	8.68
Male	6.23	3.5	8.97
Survival status of child			
Dead	5.13	2.82	7.44
Alive	6.29¹	3.61	8.96
Mother's age at birth (yrs)			
< 20	6.09a	3.66	8.52
20-24	6.21a	3.53	8.88
25-29	6.20a	3.45	8.94
>=30	6.25a	3.40	9.10
Parity			
1	5.50a	3.02	7.97
2	6.17b	3.45	8.89
3	6.66c	3.87	9.45
>=4	7.30d	4.49	10.11
Maternal BMI			
<18.5Kg/m2	6.62a	3.86	9.38
>=18.5Kg/m2	5.99b	3.43	8.54
Missing	5.41c	2.37	8.45

Note: ¹Significantly different from other value, within group, P<=0.01. ²Significantly different from other value, within group, P<=0.10. Means without common superscript letters are significantly different, P<=0.05 except few cases then it is denoted by † and ‡. † Significantly different from other value, P<=0.05. ‡ Significantly not different from other value, P<=0.05. * That particular value is not significantly different from rest of all other values, within group, P<=0.05.

mean duration of PPA was not found statistically significant for women from central, eastern and northeast regions. Further, the differences in the mean durations of PPA between women of south and east, northeast and western regions were also not found statistically significant.

In rural areas women had significantly longer durations of amenorrhea than women in urban areas. Hindu women had significantly longer durations of PPA than Muslim women. Literacy level of women was poorly associated with the mean duration of PPA (p>0.05). Wealth index of household was negatively correlated with the mean duration of PPA. Women from the poorest households had significantly longer duration of PPA than women from the richest households. The difference in the mean duration of amenorrhea between women from the poorest households and women from the richest households was about 2 months. If we move from women belonging to richest households to women of poorer households, the difference in PPA of these two groups of women reduces to 0.73 month. The difference in the duration of amenorrhea by sex of the child was small and was not statistically significant. Women whose index child was surviving had more than one month longer mean PPA than their counterparts whose index child was dead. Mother's age at birth had a positive association with the mean duration of amenorrhea (p>0.05). Younger mothers had shorter mean durations of amenorrhea than older mothers (p>0.05). However, the adjusted mean duration of PPA demonstrated a significant positive association with mother's parity and mean durations of PPA. The difference between PPAs for mothers of parity one and parity more than three was about 2 months. Undernourished mothers had significantly longer mean duration of amenorrhea compared to better nourished women. The above findings may be taken with caution due to missing information on BMI in some cases. It has been observed that mothers whose information on BMI was missing were having shorter duration of amenorrhea than mothers whose information of BMI was available.

CONCLUSIONS

Demographers have always tried to estimate the duration of PPA when its direct measurement is not available and if available then its accuracy is the matter of concern. A logistic type relationship between duration of breast-feeding and amenorrhea has been observed [9]. They have provided an exponential type of equation for predicting the duration of amenorrhea with the help of

duration of breast-feeding. Further, the inherent problem in this equation has been observed and then modified. The obtained result shows that in Turkey the mean duration of amenorrhea among never breastfed women was around 4.4 months which is higher than those women who breastfed for 8-10 months (mean duration of amenorrhea was observed around 4.0 months) [28].

There has been a renewed interest about what the optimal duration of PPA is so that women should know in advance to adopt the contraceptives for preventing unwanted births. An attempt has been made in this paper to examine after how many months of breast-feeding the contraceptive role has appeared/disappeared. The findings are that duration of breast-feeding was positively related to the duration of amenorrhea. After adjusting the important confounding factors namely, region of residence, place of residence, mother's education, standard of living, sex of index child, survival status of index child, mother's age at birth, parity and maternal BMI, there was no significant effect of breast-feeding found up to the 10th month in extending the return of ovulation after delivery. Further, we have tried to determine after how many months of breast-feeding the role in extending PPA has disappeared. But, we could not ascertain the upper limit of breast-feeding up to which it plays the role in extending the duration of PPA. Without adjusting the other factors, the result shows that the role of breast-feeding has not been seen beyond the 14th month of breast-feeding. But after retaining the important covariates at their average level and then changing the duration of breast-feeding from 6-10 months to 11-14 months, the gain in the duration of amenorrhea was around 1.3 months. Again, by changing the duration of breast-feeding from 11-14 months to more than 15 months, the gain in extending the duration was significant and was around 1.6 months. Our findings also suggest that the mean duration of amenorrhea (4.78 months) among women who never breastfed was significantly higher than those mothers who breastfed for 6-10 months (mean duration of amenorrhea was around 4.64 months). This result is true after adjusting the important confounders. So, it can safely be concluded that the period beyond 10 months of breast-feeding had a strong impact in extending the PPA. The role of breast-feeding up to 10 months was not observed as a significant protective factor. The socio-economic and demographic profile of never breastfed women was almost similar to those women who ever breastfed. However, the percentage of never breastfed women who had experienced the loss of index child was around 44 percent. In a study of the determinants of birth spacing in the Philippines, Malaysia and Indonesia through extended Cox hazards model analysis, it is also found that the association between birth spacing and breast-feeding during the initial months was not significant, but breastfeeding beyond 11 months had a significant protective impact on birth spacing [29].

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