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SOCIO-BIOLOGICAL FACTORS AFFECTING FERTILITY BEHAVIOUR IN A RURAL AREA OF BANGLADESH

by

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I. INTRODUCTION

The sociological demographic question why, in the context of no or virtually no deliberate birth control, mean birth interval varies substantially from one society to another has come to be increasingly studied in recent years. Potter has shown that birth spacing has on the average varied between two to three years among various noncontracepting populations [Potter, 1963]. Alternatively, the same question has been investigated in terms of variations, across societies, in natural fertility, i.e., fertility unmodified by deliberate birth control [Henry, 1961]. Natural fertility, defined as mean number of children per completed family of women married at the age of 20, for the Hutterites in the 19th century is found to be 10.8 children. The corresponding figure for the families of the rural Bengal in the 1940s was found to be 6.2 only [Henry, 1961]. The variations in natural fertility have been usually attributed to the following: (i) post-partum continence, (ii) occupational cycles causing post-birth spousal separation, (iii) age of entry into cohabitation, (iv) pregnancy wastage, (v) fecundity or infecundity and (vi) prolonged lactational amenorrhea, i.e., the temporary post-partum amenorrhea associated with lactation.

Specifically, however, it is lactation which has been found, on both direct and indirect evidence, to be by far the most important mechanism explaining relatively wide variations in birth intervals /‾Hyrenius, 1958; Tietze,1961; Porter, et. al., 1965; Jain, et. al., 1970; Chen, et. al, 1974_7. Studies have established fairly well that lactation prolongs post-partum amenorrhea. However, both lactation and amenorrhea vary with age of the mother /‾Potter, et. al, 1965; Jain, et. al., 1970_7.

Evidence has grown progressively also to indicate, relatively more clearly, the relative contributions of post-partum abstinence and amenorrhea to prolong the birth interval. It appears that lactation prolongs both amenorrhea and continuence. But it prolongs amenorrhea considerably more than it does abstinence /‾Potter, et. al., 1965_7. Furthermore, using multivariate analysis, it has been shown that lactation and amenorrhea are independent of parity and that socio-cultural variations, such as education and residence etc., influence amenorrhea primarily via their association with the nature of breast-feeding /‾Jain, et. al, 1970_7.

Besides all these above factors, nutritional deficiencies of lactating mothers have often been found to be associated with both lactation and amenorrhea /‾Tietze, 1961; Chen, et. al., 1974_7.

Objectives of study

In the light of the above, this paper presents the findings of a retrospective study of some aspects of birth interval dynamics in a Bangladeshi village. Our purpose is to see (a) whether the frequently reported positive association between lactation and amenorrhea is correborated by the experiences of the women studied, (b) whether the usual relationships between age of the lactating mothers and the duration of amenorrhea hold, and (c) what effect nutritional variations have on lengths of amenorrhea. The paper is structured as under. Section II describes the sources and nature of data; some characteristics of the sample, followed by a discussion of methodology and definitions used in the study. Section III presents the findings and section IV devotes to discussion of the findings and offers some concluding remakrs.

II. DATA, DEFINITIONS AND METHODOLOGY

Source of Data

The data for the study was collected during the summer of 1975. The location is a village Mithakhali in the district of Barisal, Bangladesh. At the time of the interview, there were 130 married adult males in Mithakhali and all of them were interviewed by a male interviewer. Since the survey was primarily designed to study fertility differentials due to socio-economic factors, questions asked pertained, inter alia, to landholding (owned, operated, cultivated), income, livestock and consumer durables owned, education, nutritional levels, religiosity, etc. The survey also administered a few questions to derive estimates of fertility and pregnancy wastages, as well as some others focusing on durations of post-partum amenorrhea, breast-feeding and supplementary feeding. These latter questions are given in the appendix.

The Sample

Table I presents some salient characteristics of the sample.

It can be seen from the above table that 77.69% of the women fall in the age-range 15-44. These above women constitute the core group of our analysis. Confining the study to women in the reproductive ages will permit us to separate lactational amenorrhea from amenorrhea associated with infecundity presumably setting beyond 44 years. Moreover, early marriages are seen to be common in Mithakhali. Median age at marriage is approximately 15 years. Similar evidence of early marriages has also been reported for another sample of rural women in Comilla, Bangladesh [Aziz, et. al., 1970]. Like in Bangladesh as a whoke, marriages at Mithakhali are universal: cent per cent girls here get married by the age of 20. As for fertility, 7.04 children, on the average, were reported to be ever born to women 45 years and above. This is to be compared

TABLE I

SALIANT CHARACTERISTICS OF 130 MARRIED WOMEN OF MITHAKHALI, BANGLADESH, 1975

Age (Years)	Number of Wives	% of Column Total
1. Less than 15	5	3.84
2. (a) 15 - 19	12	9.23
(b) 20 - 24	23	17.69
(c) 25 - 29	28	21.53
(d) 30 - 34	16	12.30
(e) 35 - 39	13	10.00
(f) 40 - 44	9	6.92
Sub-total 2(a) - (f)	101	77.69
3. 45 +	24	18.46
Total	130	100.00
4. Median age at marriage (years)		14.8
5. Mean number of children ever born		4.59
6. Mean number of children ever born to women above 45 years		7.04
7. Mean number of children ever born to women in child-bearing age-group		4.01
8. Proportion of women who ever practised contraception		21.5%

with 7.45 children ever born by women of Khanna Study in India [Potter, et. al., 1965]. However, for the entire sample of 130 women and for the women 15-44 years, the number of children even born is reported to be 4.59 and 4.01, respectively. It can be further seen from Table I that some of our respondents have contraception experience. Of the total number (130) of women in our study, 22% reported to have ever-used contraception and of these 54% were currently practicing contraception.

Dependent Variables

Two dependent variables are used in the study: (i) duration of post-partum amenorrhea and (ii) birth intervals .

Post-partum amenorrhea is being defined as the number of full calendar months between the date of a pregnancy termination leading to a live birth and the onset of the first post-partum menstruation[1]. Information on the duration of post-partum amenorrhea is available for 48 out of 101 women in child-bearing ages (See Table II, row A(i)). Notably, for all 48 women, except one, the amenorrhea interval was completed by the date of interview. That is, all amenorrheic experiences used in this study were entirely retrospective in nature. Pertinently, retrospective data are

[1]The determining question was, "What was the age of the last living child of your wife when she had her first post-partum menses"?

TABLE II

INFORMATION ON SOME SELECTED VARIABLES OF 125[a] MARRIED WOMEN OF VILLAGE MITHAKHALI, 1975

Description	Age of Mothers		
	15 - 44		45+
	No.	% of Column Total[b]	No.
(A) Information available on[c,d]			
i) Post-partum amenorrhea	48	47.5	0
ii) Duration for which the last surviving child was breast-fed	72	71.3	15
(B) Exposed to conception, if fecund, at interview	80	79.2	24
(C) Pregnant, at interview	12	11.9	0
(D) Have not conceived at all upto the time of interview	9	8.9	0
Total (B+C+D)	101		24

[a]The five wives, less than 15 years, have been excluded in this table;

[b]Percentages do not add to 100.0 since they are not mutually exclusive;

[c]Information is not available when there is non-response to at least one of the basic questions of the appendix.

[d]Probabilities of terminating amenorrhea or lactation have been computed on the basis of the experiences of those women for whom necessary information was available.

subject to the usual biases arising from memory lapses and recall biases. The tendency of the respondents to report termination of amenorrhea in terms of multiples of 6 months is also noted in the literature. We have discussed these limitations of data later in the paper.

Birth interval is defined as the number of full calendar months between the birth of the youngest living child and the date of interview.[1] Wives who have experienced infant mortality between birth of the youngest living child and the date of the interview are being excluded from analysis. Alternatively, birth intervals, as defined here, are the same thing as interpregnancy intervals.

Independent Variables

Three independent variables are employed in this study: (i) the duration of lactation, (ii) age of the mother, and (iii) nutritional level of the mother.

The duration of lactation was measured as the number of full calendar months for which the last child was breastfed, fully and partially. Some women had weaned by the time of the interview, and the durations of lactation for these were

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[1]The determining question was, "What is the present age of your last living child"?

measured separately from those women who were still lactating at the time of the interview. Whether a particular respondent had weaned or not was determined on the basis of the following open-ended question: "At present, is your wife lactating her last living child?" Those who were lactating at the time of the interview were then followed up with the question : "For how long has your wife been lactating her last living child?" The duration of lactation for these women was measured on the basis of responses to the above question. For women who had weaned by the date of the interview, the duration of lactation was measured on the basis of the following question, "What was the age of your last living child when it was weaned?"

To determine the onset of partial as distinct from full breast-feeding, all women, irrespective of whether they had weaned or not, were asked to recall the age of their last lactating child when food supplements of specified kind were introduced for the first time. Consequently, we were able to measure the duration of full as well as partial lactation.

Age of the mother is measured in terms of the difference, in exact years, between her date of birth and the closing date of the survey. Like in other developing countries, age data are usually poor in rural Bangladesh. They suffer from misreporting and digital preferences /_Yusuf, 1967_7. Our age data are also likely to suffer from the above deficiencies. No attempt is made here to smooth the age data to allow for this deficiency. However, we tried to obtain as accurate age data as possible through appropriate supplementary situational or historical questions intended to help respondents correctly recall their ages.

The other independent variable used is the nutritional status of the respondents. Strictly speaking, measuring nutritional levels accurately makes it necessary to know physical food consumption by respondents per stipulated unit of time. Evidently, this is a direct measurement. But such a measure becomes warranted since indirect measures are especially unsatisfactory in this case. It is often argued that rising levels of purchasing power will necessarily improve nutritional levels. Beginning with this premise, one may be inclined to use variations in income as a proxy for nutritional variations. However, this may not hold, since nutritional differences are probably as much socio-cultiral phenomena as they are economic ones /F.A.O., 1973/.

Physical consumption data should further be broken down into food components, the nutritive intakes of different food items being calculated according to roughly known nutritional equivalents of a given weight of the relevant food item /Poleman, et. al., 1973/. It is clear from the above that, if one has to get anywhere near the heart of the nutritional differences, one is to subject the respondents to prospective observation. However, measuring nutritional variations so rigorously as above was outside the purview of the rather limited scope of the Mithakhali survey.

Consequently, the nutritional levels were defined somewhat arbitarily. The following question was asked, "How many times last week did you partake of rice?" Notably, the typical rural Bengali family eat rice, the staple food of the people, thrice daily. Respondents were assigned scores on the basis of the number of rice meals they reported to have partaken in the week in question. The scores ranged from 1 through 8. The schema for assigning scores to various responses are given below:

Nutritional Score	Particular response to the above question
1	Not eaten rice at all
2	Between 1 and 3 times
3	Between 4 and 6 times
4	Between 7 and 9 times
5	Between 10 and 12 times
6	Between 13 and 15 times
7	Between 16 and 18 times
8	19 times and above

The median score is 7. But 7 is also the mean score, with a variance of 1. It is therefore the same thing whether we employ the median or the mean as the basis for classifying the nutritional status of the respondents. Weomen with nutritional scores upto 7 were called nutritionally deficient. Those who were above this score were categorised as nutritionally well-off.

A justification of why we chose to measure nutrition as above is warrnated. It may be argued that a relatively low score need not necessarily realistically stand for malnutrition for two main reasons, among others. First, this definition excludes the possibility of the respondents having benefitted from cereals other than rice, notably ground wheat, boiled potatoes, etc. Second, the calorie and protein intake by each respondent per time of his taking rice in the week in question may well have varied depending on the food-mix that went with rice. There are other deficiencies of the definitions as well, but these two should suffice for any objective critic. In particular, it appears that the possibility of supplementing rice with wheat by the respondents is indeed real especially since the relative price for the latter in the period in question has probably been favourable. In extreme cases, relatively poor respondents might even have substituted wheat for rice by exchanging own rice for purchased but relatively cheaper wheat. If, in short, the Mithakhali respondents were by and large supplementing (or substituting) rice by wheat in the summer of 1975, then our measurement of nutrition stands to lose much of its cutting power. The second qualification is equally serious. After all, a meal taken at the house of a large landowner, owning such diet-diversifying assets like poultry, livestock, tanks, orchards, is not the same nutritionally as another partaken at a marginal farmer's, presumably without any of these assets. As such, our measurement also glosses over this necessary distinction.

As against this, we have at least two reasons to argue that the realism of the first qualification to our nutritional measurement is much less than is, prima facie, the case. In the first place, there is the fact that almost the whole of the wheat that is consumed in Bangladesh is imported, domestic wheat production being virtually negligible. 90% of the imported wheat is distributed under government supervision through a rationing system, the government determining who can benefit from these imports and setting both the quantities that can be obtained and the price /Barlage, 1973_7. The market for wheat furthermore is confined to a limited number of important urban centres in Bangladesh. The rural poor, such as most of our respondents, were excluded from rationing, with its explicit subsidies, except under extremely distress situations when some wheat were distributed through gratuitous rationing /Alamgir, 1975_7. It thus seems reasonable to argue that the market for wheat in rural areas, if one existed, was essentially a fringe market. Arguably, fringe markets are often characterised by relatively exorbitant prices. The relative price advantage of wheat vis-a-vis rice in urban areas of Bangladesh may be much less substantive in rural areas. And when it is remembered that there is a clear preference on the part of the consumers for local rice vis-a-vis imported food grains, especially wheat, wheat sold in the black market (since they are leakages from the administered market) involves often a relative discount. Since transport costs are relatively high in Bangladesh, a country with poor communications, it is doubtful if any urban-to-rural trade in wheat is profitable in the light of the above argument involving a black-market discount on wheat. We are therefore assuming that the wheat market in rural areas of Bangladesh is extremely small and thus can be ignored for our purposes.

If our above arguments are valid, there is a case for saying that the posibility of supplementing (or substituting) rice by wheat did not exist in our case. Now this was a supply-oriented justification. There is another justification in terms of whether there was any effective demand for wheat on the part of our respondents. For one thing, the Aus-harvest in this village, characterised by a small farm size norm (median cultivated holding size being .68 acres only), roughly coincided with the timing of the survey. Small farmers in Bangladesh are typically subsistence ones. If so, the Aus crop should normally imply, for a family which cultivated Aus in 1975, self-sufficiency in grain for some time. 40% of the respondents grew Aus in 1975. Thus for this 40%, self-sufficiency in grain consumption can be safely assumed. Thus we found a high correlation between whether a respondent who had grown Aus in 1975 and his reported nutritional status. Respondents who grew Aus were typically above median nutritional score. Those who did not grow Aus were mostly landless, who subsist mainly on wage earnings from hiring labour services. We argue that the possibility of this segment of our respondents supplementing wheat to their diet is lower still since their demand for wheat will only be potential, if at all, and not effective. This is likely to be so since July-August in this region is a lean period with a low demand for hired labour.

So far we have tried to rationalise our nutritional measure as regards the first qualification. There is no way, however, in which we can demolish the second qualification i.e., our nutritional classification does not take income into account. To this extent, our measure is probably crude. We must however re-stress that it would be extremely painstaking to circumvent the coarseness of our measure of nutritional level with reference to the second qualification. Furthermore, we have already noted that income or wealth differentials need not always adequately reflect nutritional variations.

Methods :

Two basic methods were employed in the study to analyse the data. The first of these relates to the comparison of the conditional probabilities of resuming menstruation (or terminating lactation) for various respondents since the last pregnancy termination. These probabilities were computed from the reported durations of lactation and amenorrhea. The second method relies also on these same probabilities, except that it has presented the durations of amenorrhea and lactation in terms of measures of central tendency, especially median and the quartiles. We employed the median, as opposed to the mean, in the light of the fact that median is relatively more stable when the distributions are asymmetric. At times when the number of observations has been extremely small, we have presented the results in terms of medians and the quartiles only. All medians and quartiles are expressed in exact months, the decimals, where they occured being rounded off to the nearest full month.

Limitations of Data :

The following limitations of the data should be borne in mind throughout. First, our sample is rather small in comparison with some of the studies investigating the similar problem as ours. For example, we have information on duration of amenorrhea and lactation for only 48 and 72 women, respectively in child bearing age-group. A second limitation of our data stems from its retrospective nature and from the fact that it was the males who were responding to physiological questions pertaining to women. In particular, husbands' responses to querries on amenorrhea and lactational durations of wives will probably have a considerable margin of error. This has been a matter of some concern for us. But, given the scope of the survey, all that we did to get accurate data was to administer intensive probing questions. Nonetheless, the responses evidently contained some biases. The biases which exist in retrospective reports of the exact number of months between the birth and the ending of lactation or resumption of menstruation have been noted in literature (Jain, et. al. 1970). One possible result of this bias is that the monthly probabilities of terminating lactation or resuming menstruation are biased in favour of multiples of 6 months, which are convenient units of retrospective reporting of these experiences. Our data also have shown this tendency. Thus, for instance, in 38 out of the 48 cases for which information is available on post-partum resumption of menstruation or, in other words, in 79% of the cases, the reported durations of amenorrhea lengths are in multiples of 6 months. Again 80% of the reported terminations of lactation also were in multiples of 6 months. The above bias relating to durations of lactations and amenorrhea may also apply to the birth interval data. In this study 72% of the reported ages of the last child happen to be in terms of multiples of 6 months. This compares rather favourably with the 79% for both reported durations of lactation and amenorrhea. The question arises to what extent this type of biases may affect our results. There are reasons to believe that measures of central tendency such as the mean and median should not be greatly affected by the above biases[1]. A cognate limitation of the data arises from the fact that various durations are measured in months. Over and above the tendency on the part of respondents to round a given age of her (or his) child at the time of a given experience off to the nearest multiple of 6 months, there is the further probability of errors due to the tendency to stagger durations that fall short of a month to the nearest full calendar month. This latter coarseness of measurement, Potter et. al. have argued, results in biases of two weeks or more, which are trouble some especially when the duration at hand is short, as instanced by post-partum amenorrhea following a miscarriage [Potter, et. al., 1965]. Since we are not concerned with relative durations of amenorrhea associated with various outcomes of previous delivery, this particular limitation of the data is not very consequential for our purposes.

A final limitation of the data relates to the evidence of practice of contraception among a section of women in the sample. In view of this fact, it becomes necessary to ask whether contraception should be regarded as a factor affecting amenorrhea. We found out that the pattern of the durations of amenorrhea and lactation remained roughly the same, irrespective of whether we included or excluded the women who had ever used contraceptives. That is to say contraception does not affect either lactation or amenorrhea. These findings are also corroborated by others. [Potter et. al., 1965; Jain, et. al., 1970]. As such, contraception does not constitute a consequential limitation of our study.

[1]It may be assumed that the respondents had rounded off durations of amenorrhea and lactation to the nearest multiple of six months. As such, while some respondents are likely to underestimate the true duration, other may have overestimated it. Consequently, measures of central tendency, like median, may be relatively unaffected, since the above biases may concel themselves on the whole.

III. FINDINGS

The findings are arranged as under. First, we have presented data on birth intervals. Then we have examined the bi-variate relationship between amenorrhea and lactation. Subsequently, we have examined the above relationship by age and nutritional status. Finally, we examined the net relationship between lactation and amenorrhea holding age and nutritional status constant.

Birth intervals in Mithakhali

Table III shows the distribution of Mithakhali mothers by age and birth interval.

It can be observed from this table that the birth intervals for the Mithakhali women are very large. More specifically, mean birth interval for the women aged 15-44 years is found to be about 32.5 months.[1] These birth intervals are open, and are likely to be longer when they are completed. Speaking alternatively, about 25% of the women in reproductive ages had delivered the last live-birth (not followed by any subsequent conception) between 48 to 80 months and above before the interview. (See Table III, the last five rows from the bottom). The above picture of birth intervals

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[1] We employ mean here in order to facilitate comparison between birth intervals for women at Mithakhali with those, typically expressed in terms of mean, for other societies.

is consistent with the picture reported for some other societies [Potter, 1963]. The question arises now of what accounts for these very high birth intervals.

We first examine the extent to which the observed birth intervals were due to the practice of contraception. This, we thought, could possibly explain part of the phenomenon, since contraception affects birth intervals by its impact on the menstruating intervals. Out of 78 women in reproductive ages (15-44) in our sample 9 were contracepting at interview.[1] Another 5 used contraceptives in the past. Thus about 18% of the women have ever-used contraceptives. Only in these cases contraception could be a factor in promoting birth spacing. The average length of birth intervals for women who have ever-used contraceptives is found to be 36 months. In sharp contrast, the corresponding duration for the women who never-used contraception was found to be 47 months, or nearly a year longer. This finding is somewhat at variance with a priori expectation. One would normally expect women who ever-used contraceptives to have longer birth intervals, ceteris paribus, than those who never practised it.

There can be several reasons for this finding. First, the finding may be due solely to the very small number of women (14) who have ever-used contraception. There is a possibility that the shorter birth intervals ...

[1] We have indicated earlier that 15 out of the 130 women surveyed were currently practising contraception. This means that 6 women past reproductive ages were still practising contraception. There may be two explanations for this. The first relates to age misreporting. It is possible that women in 15-44 years group have been erroneously reported as past 44 years. The second relates to the admittedly uncommon case of women past 44 years being fecund as yet and therefore seeking to prevent births.

TABLE III

DISTRIBUTION OF MITHAKHALI WOMEN BY AGE AND BY THE PERIOD SINCE THEIR LAST DELIVERY LEADING TO A LIVE BIRTH AND NOT FOLLOWED BY ANY SUBSEQUENT CONCEPTION

Months since last delivery	Age (Years)					
	15 - 44		45+		All Women	
	No.	%	No.	%	No.	%
0 - 7	11	14.10	0	0.00	11	11.70
8 - 15	11	14.10	2	12.50	13	13.82
16 - 23	11	14.10	0	0.00	11	11.70
24 - 31	18	23.08	0	0.00	18	19.15
32 - 39	6	7.69	1	6.25	7	7.44
40 - 47	1	1.28	0	0.00	1	1.06
48 - 55	4	5.13	0	0.00	4	4.25
56 - 63	2	2.56	1	6.25	3	3.19
64 - 71	1	1.28	0	0.00	1	1.06
72 - 79	4	5.13	2	12.50	6	6.38
80 +*	9	11.54	10	62.50	19	20.21
Total[a]	78		16		94	

Mean open intervals between birth for women, aged 15-44 years (months)[b]	32.5
Median open interval between births for women, aged 15 - 44 years (months)[b]	26.0

[a]The total of 94 falls short of the sample total of 130, because women who experienced infant mortality between their last live-pregnancy and the interview were excluded.

[b]Note that the last birth class is an open one.

*To compute the mean, we have assumed the mid-point of this class to be 83 months. This procedure will underestimate the resulting median and mean, since a few birth were outside the birth interval implied by the mid-point of 83 months.

among ever-contraceptors may be a reflection of sampling fluctuations. Second the contraception status of the respondents was ascertained with respect to the following questions: "Have you ever-used contraceptives of any kind?" and, "Are you using any contraceptives at present?" While the responses to these questions enabled us to asertain contraception status of the respondents in a general way, they had left the following important questions unanswered. In what stage of their life-cycles had the ever-users began the practice of contraceptions? For what duration and how effectively had they practised contraception? Given our ignorance of the answers to these questions, the fact that the practice of contraception did not have the expected effect on the birth intervals need not necessarily come as a surprise.

From the above, it appears that contraception is not a convincing factor explaining the observed spacing between births. One possible explanation ofthe birth intervals may be prolonged lactational amenorrhea. This we examine next.

Amenorrhea and lactation

Table IV examines the comparative duration of post-partum amenorrhea and lactation.

It is quite clear from this table that women in our sample are lactating their children over an extended period. Median duration of lactation (full and partial combined) is

TABLE IV

PROPORTION OF WOMEN, 15 - 44 YEARS, IN POST-PARTUM AMENORRHEA, AND STILL LACTATING AT THE END OF PARTICULAR MONTHS FOLLOWING THE LAST DELIVERY, MITHAKHALI, BANGLADESH, 1975

Months since last birth	In Post-Partum Amenorrhea		Still Lactating			
			Fully		Fully & Partially	
	Mitha-khali (n=48)	Matlab (n=83)	Mitha-khali (n=64)	Matlab (n=83)	Mitha-khali (n=72)	Matlab (n=83)
0	1.00	1.00	1.00	1.00	1.00	1.00
1	1.00	1.00	0.67	0.94	0.97	1.00
3	0.86	0.97	0.56	0.83	0.96	1.00
6	0.68	0.92	0.47	0.68	0.88	0.98
12	0.47	0.72	0.11	0.33	0.74	0.93
18	0.29	0.45			0.58	0.73
24	0.23				0.40	0.52
30	0.18				0.20	

[a]All data relating to Matlab are taken from Chen, et. al., [Chen, et. al., 1974].

about 23 months, the first and third quartiles falling in 12th and 29th months, respectively. However, the median lactational duration for these women is shorter than the corresponding duration reported for another group of village (Matlab) women in Bangladesh [Chen, et. al., 1974]. 50% of the Mithakhali wives subjected their children to full breast-feeding for a period of about 5 months, at which time food supplements are introduced. The corresponding figure for the Matlab women is found to be 9 months [Chen, et. al, 1974]. It thus appears that the Mithakhali women are lactating for a shorter period than the Matlab mothers. If lactation indeed prolongs amenorrhea, then the Mithakhali women should probably be characterised by a shorter median duration of amenorrhea than the women of village Matlab. It is reassuring to see that this is indeed the case. The median duration of post-partum amenorrhea in our sample is exactly 10 months, with the first and third quartiles falling in the 4th and 18th months, respectively. On the other hand, the median amenorrhea for the Matlab respondents was computed to be 17 months [Chen, et. al., 1974]. The first and third quartiles for these women were not reported, but they may well be higher.[1] Two things emerge from these findings. First, lactation is playing a role presumably with other factors, to prolong amenorrhea for the women studied. Second, typically lactating for a

[1] This would not hold, however, if the two underlying distributions were highly asymmetrical with respect to each other.

shorter period than the women at Matlab, Comilla, the women at Mithakhali are experiencing shorter median durations of amenorrhea. There is indirect evidence here that lactation prolongs amenorrhea. The question arises of whether our data also bear any direct evidence that lactation prolongs amenorrhea. We examine this in the next sub-section.

Lactation and Amenorrhea: More Direct Tests

Table V shows the comparative duration of post-partum amenorrhea for women with different breast-feeding experiences.

Col. (1) shows the conditional probability of women who were lactating their children at interview resuming menstrunation at the end of specified months after last live birth. Col. (2) and (3) show the same probabilities for women who had weaned by interview but who had lactated for different durations. While interpreting the findings of the table, the following caveat has to borne in mind. A look at col. (1) suggests that the women who had not weaned at interview have apparently resumed menstrnation faster in comparison to other lactational groups. Thus, it may be argued that while only 27% of the mothers still lactating at the time of interview remain amenorrheic 12 months after last live-birth, the corresponding proportion for the women who had weaned is 60% (Col. 4, Table V). But the fact is that the above argument is a non sequitur. This is so because the mothers in Col. (1) have a median duration of lactation of only eight (8) months. This is

TABLE V

PROPORTION OF MOTHERS IN POST-PARTUM AMENORRHEA BY DURATION OF LACTATION, BY MONTHS SINCE LAST LIVE BIRTH, MITHAKHALI, BANGLADESH 1975[a]

Months since last delivery	Breastfed last child				Total
	Head not Weaned (n=22)	Had weaned, by Mos. of Lactation			
		1 - 24 (n=10)	25+ (n=16)	All (n=26)	(n=48)
0	1.00	1.00	1.00	1.00	1.00
1	1.00	1.00	1.00	1.00	1.00
3	.82	.67	1.00	.88	.86
6	.59	.56	.75	.68	.68
12	.27	.56	.62	.60	.47
18		.22	.50	.40	.29
24		..11	.44	.32	.23
30			.38	.28	.18
36					
Median	8	13	18		
First quartile	5	3	6		
Third quartile	19	17	34		

[a]The second panel presents the median and quartiles for post-partum amenorrhea for three lactational groups.

much lower than the corresponding figure for the mothers who had weaned . Therefore, the markedly early resumption of menstrnation of these mothers can be considered to be a statistical artifact of their significantly lower duration of lactation.

It is the cols. (2) and (3) which are our centre of attention in this table. Although the number of cases involved are small, there is a clear positive relationship between the duration of lactation and amenorrhea among women who had weaned by the date of the interview. The median duration of post-partum amenorrhea for women having lactated upto 24 months is 13 months. But this is considerably shorter than the corresponding duration of 18 months for women who lactated longer than 25 months. The finding is also in close conformity with findings reported by others /_Jain, et. al., 1970_7. However, it must be borne in mind that the above table examines only a bi-variate relationship between lactation and amenorrhea and thus remains unadjusted, among others, for mother's age which has often been observed to be positively related with both amenorrhea and lactation /_Potter, et. al., 1970_7. In the following sub-section, we examine the the relationships between lactation and amenorrhea by age of the mother.

Amenorrhea, Lactation and Age

Table VI examines the bi-variate relationship between amenorrhea and age on the one hand and between lactation and age, on the other.

TABLE VI

DURATION OF AMENORRHEA AND LACTATION BY AGE, MITHAKHALI, BANGLADESH, 1975

	Post-Partum Ammenorrhea			Lactation		
	Age (Years)			Age (Years)		
Measure	15-30 (n=26)	31-44 (n=22)	All (n=48)	15-30 (n=44)	31-44 (n=28)	All (n=7
Median	5	17	10	17	29	23
1st Quartile	3	10	4	6	20	12
3rd Quartile	8	22	18	21	35	29

It shows, as other studies have shown in the past, that age is positively associated with both amenorrhea and lactation. Thus 50% of the women, of 15-30 years of age, have a duration of amenorrhea of 5 months, with the central 50% of the cases terminating amenorrhea between 3rd and 8th months. The corresponding number of months for women, 31-44 years of age, are respectively 17.6 and 21. Likewise, the younger women lactate upto a median period of 19 months, while the older ones have a corresponding figure of 29 months. The above findings clearly demonstrate that age of the mother is directly related to lactation and amenorrhea. It is therefore necessary to control for age while examining the relationship between amenorrhea and lactation. The zero-order correlation coefficient between lactation and amenorrhea is found to be .56 (See Table IX). However, the partial correlation coefficient between lactation and amenorrhea, age being controlled, is .54. The two coefficients are roughly the same and, this being the case, we can argue that lactation affects amenorrhea independently of age. This finding too is consistent with the findings reported elsewhere [Jain, et. al., 1970]. Now we are left with exploring whether there is any factor other than lactation that influences amenorrhea. This we do in the next subsection.

Amenorrhea, Lactation and Nutrition

Nutrition is often suggested to be a strong correlate of amenorrhea and lactation. This suggestion is borne out by several empirical observations. Often, women in countries with high per capita incomes and high nutritional levels are found to be lactating and amenorrheic for significantly shorter durations than women in countries were per capita incomes and nutritional levels are low. Thus, Tietze reviewed evidence showing that three groups of American mothers were experiencing much shorter durations of amenorrhea and lactation than a group of Indian women [Tietze, 1961]. This finding raised the question whether dietary inadequacies might, apart from prolonged lactation, also prolong amenorrhea. A similar suggestion was also made elsewhere in the literature. Thus, Chen et. al, reported that the Bengali women in their sample were much slower in terms of resuming post-partum menstruation, the type of lactation being standardised, than a group of Chilean mothers. Since there is evidence of widespread amenorrhea during severe food shortages and famines due presumably to malnutrition they suggested that nutritional deficiencies among mothers at Matlab, Bangladesh may well be prolonging the lactational amenorrhea further than otherwise would be the case. The inference about nutritional factors stemmed quite naturally from reliable accounts of frequent and widespread material malnutrition present in Bangladesh [World Bank, 1972].

Table VII examines the bi-variate relationship, respectively, between amenorrhea and lactation on one hand and nutritional levels on the other.

TABLE VII

PROPORTION OF WIVES IN POST-PARTUM AMENORRHEA, AND STILL LACTATING, BY NUTRITIONAL STATUS SINCE LAST LIVE BIRTH, MITHAKHALI, BANGLADESH, 1975

Months since Last Delivery	In Post-Partum Amenorrhea		Still Lactaging	
	Nutritional Score[a]		Nutritional Score	
	Upto 7 (n=24)	Above (n=22)	Upto 7 (n=40)	Above (n=30)
0	1.00	1.00	1.00	1.00
1	1.00	1.00	.98	.97
3	.83	.84	.95	.97
6	.67	.58	.85	.90
12	.46	.39	.75	.73
18	.38	.05	.57	.57
24	.25		.40	.40
30			.15	.26
Median	11	8	20	20
1st Quartile	4	4	12	11
3rd Quartile	24	14	28	31

[a]Nutritional information for 2 respondents was not available.

The table shows that the median duration of amenorrhea for nutritionally well-off women is 8 months, with the first and third quartiles falling in the 4th and 14th months. These figures are to be compared with 11, 4 and 24 months for the nutritionally deficient group. Quite clearly, malnutrition is seen to have a certain prolonging impact on amenorrhea. Roughly, the same conclusion emerge from the figures in the upper panel of the table. Thus, while 38% of the nutritionally deficient group remain amenorrheic for 18 months after the last live-birth, the corresponding proportion for the nutritionally well-off women is only 5%.

As far as lactation is concerned, the conditional probabilities for the two nutritional groups do not seem to show any regular pattern. Thus exactly 57% of the women in both nutritional categories are lactating at the end of 18 months from last birth. Likewise, the median durations of lactation for the two groups are the same at 20 months. The differences between the first and third quartiles are also not very high. Thus it appears that, for the women studied, nutritional variations are inversely related with the conditional probabilities of the resumption of menstruation, although their relationship with termination of lactation is less clear.

The question now arises whether the bi-variate relationship between amenorrhea and lactation changes when nutritional differences are adjusted for. We computed the partial correlation coefficient between amenorrhea and lactation, holding nutritional scores constant. It turned out to be .55 and not different from the zero-order correlation coefficient between them (.56). From the above findings, one is inclined to conclude that the observed relationship between lactation and amenorrhea is independent of nutritional status.

But it should be noted here that the above correlation results may well be due to the coarseness of our measure of nutritional status. Clearly, nutritional scores displayed little variation. Theoretically, there could be a maximum variation from 1 to 8. In practice, the range was narrower (6-8). This lack of variability of nutritional score has produced a small r between amenorrhea and nutrition on the one hand, and between lactation and nutrition, on the other. (Table IX). It is therefore necessary to apply some other appropriate statistical tests to take account of the coarseness of the measure. For this, we have applied Yule's Q [Yule, 1912] to examine the relationship between amenorrhea and nutrition on the one hand, and lactation and nutrition on the other. The value of Q between amenorrhea and nutritional levels is found to be -0.39. Given the value of Q, the association between amenorrhea and nutrition can be considered to be moderately negative [Davis, 1971]. On the other hand, the value of Q between lactation and nutrition is found to be -0.10 only. The Q between amanorrhea and lactation was found to be .53. But the value of Q between amenorrhea and lactation, holding nutritional status constant, drops to .53. From these findings one can see that nutritional variations have a certain independent effect on the observed relationship between lactation and amenorrhea.

Amenorrhea, age and nutritution

We have seen that age associates positively, and nutrition negatively, with amenorrhea (See Tables VI and VII). But it is quite important to ask whether age prolongs amenorrhea even when nutritional levels are held constant, and conversely. Our limited data show that this appears to be the case (Table VIII).

The table shows that, given the same nutritional levels, amenorrhea varies positively with age. Further, it shows that, within the same age-group, amenorrhea varies inversely with nutritional levels. It shows also that women who are both relatively young and nutritionally well-off have the shortest median duration of amenorrhea. In contrast, women who are both relatively old, i.e. 30 years and above, and nutritionally badly-off have the longest median amenorrhea duration.

The question now arises whether the observed relationship between amenorrhea and lactation remains unchanged when we control both age and nutritional level. For this we computed the second order partial correlation coefficient between lactation and

TABLE VIII

MEDIAN DURATION OF POST-PARTEM AMENORRHEA BY NUTRITIONAL SCORES AND AGE, FOR MARRIED WIVES IN CHILD BEARING AGES, MITHAKHALI, BANGLADESH, 1975 (MONTHS)

Nutritional Score	Age (Year)	
	Less than 30	30 and Above
Upto 7	11 (n=11)	18 (n=13)
Above 7	6 (n=12)	12 (n=10)

amenorrhea, holding age and nutrition constant. This partial coefficient works out at .50 and is not significantly different from the zero-order correlation coefficient between amenorrhea and lactation. We have also computed the second-order Q between amenorrhea and lactation, holding both age and nutrition constant, in order to take account of the coarseness of our nutritional measurement. This is found to be 0.38 and is relatively closer to zero-order Q between lactation and amenorrhea (0.53) than the first-order Q between lactation and amenorrhea (0.33), holding nutrition constant. In other words, the original association between lactation and amenorrhea is changed relatively more markedly when only nutrition is being controlled than when nutrition and age are both being controlled. This may be explained as follows. We have noted before that controlling for age did not change the original relationship between lactation and amenorrhea (p. 24). We also found that nutrition had a modest independent effect on amenorrhea. However, age has an inverse but weak association with nutrition. (Table IX). As such, when the relationship between amenorrhea and lactation is being examined, both age and nutrition being controlled, it is possible that age neutralises part of the independent effect of nutrition on amenorrhea.

Amenorrhea, Lactation and other Socio-economic Variables

Finally, it is necessary to examine whether there is any relationship between amenorrhea and other socio-economic variables. This is so because there is evidence in the literature that certain aspects of modernisation, especially education, influences lactation and, in turn, amenorrhea /̲Jain, et. al., 1970_7. This we take up next.

Apart from maternal age and nutritional level, the survey generated household-specific data on parental education, parity, yearly income from all sources, landowned and operational holdings. Table IX shows the zero-order correlation coefficients between amenorrhea and lactation on the one hand and these variables on the other.

The table shows that, apart from lactation, age has the highest correlation coefficient with post-partum amenorrhea. The table also shows that all the variables measuring socio-

TABLE IX

ZERO-ORDER CORRELATION COEFFICIENTS BETWEEN SELECTED VARIABLE FOR 48 MARRIED WOMEN, AGED 15-44 YEARS, MITHAKHALI, BANGLADESH, 1975

	Variables							
Variables	L	A	N	P	E	Y	L_1	L_2
Amenorrhea	0.56*	0.30**	-0.11	-0.04	-0.08	-0.17	-0.05	-0.06
Lactation(L)		0.20	-0.11	0.01	-0.18	-0.48**	-0.05	-0.10
Age (A)			-0.03	0.66*	-0.08	0.14	0.11	0.06
Nutrition (N)				0.04	.03	0.16	0.13	0.08
Parity (P)					0.16	0.51*	0.49*	0.42*
Education (E)						0.03	0.10	0.29**
Income (Y)							0.60*	0.67*
Land Owned (L_1)								0.71*

*significant at 1% level.

**significant at 5% level.

economic status (e.g., education, income, land ownership, nutritional levels) have consistently negative relationship with both lactation and amenorrhea. Confining to income and education, it may be argued that variations in these status variables affect amenorrhea primarily by affecting the practice of breast-feeding. The correlation coefficient between amenorrhea and income (-.17) is not significant statistically. However, income has a very significant relationship with lactation. Education appears to have a stronger relationship with lactation than with amenorrhea. It therefore appears that indices of socio-economic status inversely affect amenorrhea primarily through their negative influence on the duration (and probably intensity) of breast-feeding. A similar finding has been reported for Taiwanese women [Jain, et. al., 1970].

We also computed the first-order correlation coefficient between lactation and amenorrhea, with income and education alternatively held constant, in order to see whether income and education have any independent effect on amenorrhea. The zero-order r between lactation and amenorrhea (0.56) dropped to 0.54 when only income was controlled. The corresponding r remained unchanged at 0.56 when only education was controlled. The second- order r between lactation and amenorrhea, both education and income being controlled, is found to be 0.54. From all these findings, it appears that these status variables do not have an independent impact on amenorrhea. They affect amenorrhea solely through their negative impact on the practice of breast-feeding.

IV. DISCUSSION

This paper presents, in the context of Bangladesh, some empirical evidence indicating the relative influence of physiological vis-a-vis cultural and/or economic factors on the termination of amenorrhea following live birth.

The study corroborates the earlier findings pertaining to both Bangladesh and other countries in Asia and Latin America, that the practice of breast-feeding, a cultural factor, delays the termination of post-partum amenorrhea.

Age is positively related to both lactation and amenorrhea (Table IX). However, the relationship between lactation and amenorrhea is not attenuated when allowance is made for age. One reason is that, a large part of the influence of age on amenorrhea is seen to be exerted through lactation. As such, it is not surprising to see that controlling for age does not affect the original association between lactation and amenorrhea.

Our paper has shown that nutrition, a cultural and economic factor, has a moderate independent effect on amenorrhea. Moreover, nutrition appears to shorten amenorrhea, given the age of the mothers.

Finally, it seems that women with higher socio-economic status lactate for shorter durations than those with lower status. As such, the former remain amenorrheic for shorter spell of time than the latter. Since education, income and nutrition are essential aspects of modernisation, ans since all the three correlate inversely with both lactation and amenorrhea, there is a case that modernisation in a non-contracepting country may, on the whole, may increase the proportion of child bearing women at risk to conception at a given point in time. In fairness, however, it must be said that modernisation, by raising educational levels, may lead to the practise of effective contraception /̲ Chowdhury, 1976 _7. The anti-natalist impact of modernisation may overwhelm its pro-fertility impact. The demographic experience of the developed countries, especially those which experienced fertility decline, clearly bears this out.

In sum, the paper proves that prolonged lactational (and probably nutritional) amenorrhea is the dominant mechanism for causing considerably long birth intervals among mothers in reproductive ages in rural Bangladesh. As such it is seen to be an influential determinant of rural fertility in a low-income area.

Appendix

The following questions were asked to help estimate (a) the duration of post-partum amenorrhea and of lactation, (b) the duration of full versus partial breast-feeding.

Q. 1. What the age of your last living child now?

____________ Years   ____________ months

Q. 2. Did your wife experience any infant mortality after the birth of your last living child?

a. Yes;   b. No

Q. 3. At present is your wife lactating her last living child?

a) Yes;

b) No /Skip to Q.5/

c) Never lactated the last surviving child /Skip to Q.7/[a]

Q. 4. How long has your wife been lactating her last living child for?

____________ years   ____________ months.

Q. 5. When, for the first time, one or more of the following food supplements were introduced[b], lactation apart?

---

[a] Note here that every one of the women, 15-44 years of age, was reported to have lactated her last surviving child.

[b] At times, more than one of the food supplements cited were introduced, not necessarily simultaneously. In such cases, the age of the child at the earliest introduction was taken as the basis of estimating the onset of partial breast-feeding.

Food Item	Last child's age at introduction	Daily frequency of lactation
1. Other milks		
2. Biscuits		
3. Rice		
4. Loaf		
5. Eggs		
6. Meat		
7. Fish		
8. Fruits		
9. Vegetable		
10. Potatoes		
11. Others		

Q. 6. What was the age of the last child when it was weaned

________ Years   ________ months

Q. 7. Has your wife menstruated subsequent to the birth of her last living child?

a) Yes;   b) No

Q. 8. What was the age of this child when your wife resumed the first post-partum menstruation?

a) ________ Year   ________ month

b) Do not know

REFERENCES

1. Alamgir, M., "Some Aspects of Bangladesh Agriculture: Review of Performance and Evaluation of Policies", The Bangladesh Development Studies, Vol. III, No. 3, July 1975.

2. Barlage, L., "An Application of Dynamic Programming Models to Foodgrain Impart and Storage Policy in Bangladesh, The Bangladesh Development Studies, Vol. I, No. 4, October 1973.

3. Aziz, K.M.A., Chowdhury, A.K.M.A., and Mosley, W.H., "Pattern of Marriage: A Study in Rural Bangladesh", Presented at the Sixth Annual Conference of the Pakistan Sociological Association, Lahore, July, 1970.

4. Chaudhury, R.H., "Education and Fertility in Bangladesh", A paper presented to the Second Annual Conference of the Bangladesh Economic Association, held in Dacca, March 1976.

5. ________, "Socio-cultural Factors Affecting Practice of Contraception in a Metropolitan Area of Bangladesh", Bangladesh Institute of Development Studies, 1976 (mimeo.).

6. Chen, L.C., Ahmad, S., Gesche, M., and Mosley, W.H., "A Prospective Study of Birth Interval Dynamics in Rural Bangladesh". Population Studies, Vol. 28, 1974.

7. Davis, J.E., "Elementary Survey Analysis", (New Jersey, Prentice - Hall, 1971).

8. Food Policy and Nutrition Division, FAO, "Food and Nutrition: A New View of an Old Problem", Nutrition News letter, Vol. II, No. 4, October - December, 1973.

9. Henry, L., "Some Data on Natural Fertility, "Engenics Quarterly, Vol. 8, No. 2, 1961.

10. Hyrenius, H., "Fertility and Reproduction in a Swedish Population Group with Family Limitation", Population Studies, Vol. 12, No. 4, 1958.

11. Jain, A.K., Hsu, T.C., Freedman, R., and Chang, M.C., "Demographic Aspects of Lactation and Post-Partum Amenorrhea", Demography, Vol. 7, No. 2, May 1970.

12. Poleman, T.T., Perera, L.N., Fernando, W.S.M., Beatrice, V.M., "The Effect of Income on Food Habits in Sri Lanka", Nutrition News letter, Vol. II, No. 3, July-September, 1973.

13. Potter, R.G., "Birth Intervals: Structure and Change, Population Studies, Vol. 17, 1973.

14. __________, Mary, L.N., Wyon, T.B., Gordon, J.E., "Applications of Field Studies to Research on the Physiology of Human Reproduction: Lactation and Its Effects upon Birth Intervals in Eleven Punjab Villages, India", in Sheps, M.C. and Ridley, J.C. (eds.) "Public Health and Population Change", (Pittsburgh, 1965).

15. __________, Wyon, J.B., Parkar, M., and Gordon, J.E., "A Case Study of Birth Interval Dynamics", Population Studies, Vol. 19, July 1965.

16. Tietze, C., "The Effect of Breast-feeding on the Rate of Conception, "International Population Conference: New York, 1961, Vol. II, (London, 1963).

17. World Bank, "Land and Water Resources Sector Study, Bangladesh, Volume IX, Technical Report No. 28", 1972.

18. Yule, G.U., "On the Methods of Measuring Association Between Two Attributes", Journal of the Royal Statistical Society, Vol. 75, 1912.

19. Yusuf, F., "On the Extent of Digital Preference in Reporting of Ages in Pakistan", The Pakistan Development Review, Vol. VII, No. 4, Winter 1967.