II. NUTRITION AND INFECTION

1. STUDY OF LACTATION RELATED CHANGES IN BONE MASS IN WOMEN FROM LOW SOCIO-ECONOMIC GROUP

   Breast feeding is associated with transfer of approximately 200mg/day of calcium from mother to the infant. Earlier studies have demonstrated that this increased calcium demand leads to mobilisation of this important mineral from the mother’s skeleton, leading to transient reduction in bone mineral density (BMD) of lumbar spine and femoral neck regions (4-7%) during 3-6 months of lactation (Sowers et al., JAMA, 1993; 266:3130-5, Affinito et al., J Clin Endocrinol Metab 1996; 81:2314-8).

   Complete restoration of bone density after weaning has been reported in some studies. The subjects in such studies had high dietary intake of calcium (>1gm/day) and shorter duration of lactation (<6 months). On the contrary, poor Indian women subsist on a diet with inadequate calories, proteins as well as calcium and they continue to breast feed for a prolonged period of time (>1year). It is possible that the calcium from their diet is inadequate to allow bone-accretion during the recovery period. This study was therefore, initiated to investigate whether lactating women from low socio-economic group lose bone mass during postpartum period and whether low calcium intakes allow restoration of bone density.

   This study was approved by the Institutional Ethical Committee.

METHODOLOGY

Sample size

Since there was no available data from India, sample size was arrived at based on initial and six months BMD values generated in a small number of women. The sample size required worked out to be 40.

Fifty postpartum tubectomised women who came to Nutrition Unit in Government Maternity Hospital for their first check-up after delivery were recruited for this study. Their baseline anthropometry and bone density was studied by DEXA (4500 W, Hologic) at lumbar spine (LS), Hip including femoral neck (FN), forearm and Whole Body Bone Mineral Content (WBBMC) within one month after delivery. Fasting blood sample was collected for biochemical investigations like Hb, serum calcium, serum phosphorus, serum proteins, serum total and bone specific alkaline phosphatase and serum total and bone specific acid phosphatase. Breast milk sample was collected for estimation of calcium. Dietary intake was estimated in a sub-sample of women at 2 time points by 24 hrs recall method. First within 6 months after delivery and then at around 1½ years after delivery. These subjects were followed-up and their bone density measurement and biochemical parameters were repeated at 6 months, 1 year, and 1½ years.

Results

Out of the fifty recruited women who had DEXA measurement at baseline, 26 subjects have completed the 1½ years follow-up. Another 15 women are expected to complete their follow-up by June 2004.

   Thus, in 26 subjects the bone density measurements were repeated at all four time points i.e. baseline, 6 months, 1 year, and 1½ years after delivery and the results are as follows.
1. Characteristics of the study group at baseline (Mean ±SD) (n=26)

- Age - 23.4 ± 3.75 yrs
- Parity - 2.6 ± 0.79
- Weight - 46.3 ± 5.39 kg
- Height - 150.7 ± 4.77cm
- BMI - 20.4 ± 2.65

Bone density of a woman being studied on DEXA

The anthropometric parameters correspond with those reported by the NNMB and are thus representative of the low socio-economic group.

1. Duration of breast feeding and return of menstruation: Twenty three out of twenty six women were breast feeding their children even at 1½ years after delivery. Two women stopped after 6 months and one woman stopped feeding after one year.

2. Resumption of menstruation was at 6.7±4.83 months post partum. Dietary intake of all the nutrients including energy (1900±460 Kcal/day), proteins (43±12 g/day) and calcium (448±223.7 mg/day) were below RDA and were not different at the two time points. They were also less than that reported by the NNMB survey.

3. Changes in Bone density parameters during lactation: The BMD of the hip, spine and forearm and WBBMC were much lower than those reported from the Western studies in the similar age groups. But they are similar to those reported for the low socio-economic group from this institute (Ann.Rep.2002).

i) BMD at femoral neck - At 6 months after delivery, there was a 4.5% (±5.52) (P<0.005) loss of the BMD and it was maintained till one year after delivery. There was only a partial recovery of BMD at 18 months but it was still lower by 2.2% (±5.53) from baseline (P<0.05).

ii) BMD at lumbar spine (LS-BMD) – There was no loss of BMD due to lactation at 6 months after delivery and BMD increased significantly later on at one year and it was 3.1% (±5.17) (P<0.05) more than the baseline value. The upward trend was observed even at 18 months as BMD was 5.8% (± 5.66) (P<0.001) more than at the baseline.

iii) BMD at forearm - At 6 months after delivery, there was no loss of BMD. But it decreased later and at 1 year, there was a deficit of 2.4% (±3.16) (P<0.05) from the baseline. But the BMD showed complete recovery by 1½ years.

iv) WBBMC - There was a loss of WBBMC [1.6% (±3.2) (P<0.05)] at 6 months. But value at one year showed an increasing trend and at one and half year recovery was complete.
It is observed that the 4 sites exhibit different patterns of change during lactation, probably because of the difference in the cortical and trabecular bone with FN having mainly cortical, LS mainly trabecular (which has a high remodelling rate) and forearm, a mixture of the two. In addition, these women had not reached their peak bone mass which may explain the continued gain of LS-BMD after 6 months inspite of prolonged breast-feeding. Even at the FN site, opposing effects of calcium drain for lactation and accrual of peak bone mass resulted in a much smaller loss than that expected due to low calcium intakes. There was a wide variation in the pattern of BMD changes. Hence the women were divided into two groups to see if the women who gained BMD at 6 months (LS-BMD) were younger (and had not achieved PBM) than those who lost BMD.

First group included those who lost LS-BMD at 6 months (n=18) (mean loss of 3.8±2.04%) and the second group included those who gained LS-BMD at 6 months (n=9) (mean gain of 3.2±4.79%). When these two groups were compared, there were no differences seen in their mean age, height and baseline LS-BMD. But there were significant differences in their body weights as well as BMI, with the second group having better nutritional status than the first one (Weight – 49.4±6.76 Vs 44.7±3.89 kg) (P<0.05) and (BMI –21.9±3.07 Vs 19.6±2.05) (P<0.05). This reflects the role of nutrition.

Resumption of menstruation was also reported to be earlier in the second group than the first one (4.2±4.41mths vs 8.0±4.6mths) (P=0.05). Among biochemical parameters, both the markers of bone formation (Bone specific alkaline phosphatase) and bone resorption (Bone specific acid phosphatase) did not show significant change during lactation but a trend was seen for the decrease in the level of bone specific acid phosphatase at 6 months (7.5±1.29 IU/L at baseline Vs 5.9±3.74 IU/L at 6 months) (P=0.07). Breast milk calcium of these women was 218±73.2mg/L, which is similar to the reported values. Inspite of low intake and prolonged drain of calcium through breast milk, LS-BMD continued to rise in better-nourished mothers. It is possible that conservation of calcium occurred through either increased absorption or reduced excretion or both. But these compensatory mechanisms could offset the breast milk calcium loss only in mothers with better nutritional status.

Thus it can be speculated that, at the time of building maternal peak bone mass, in spite of low calcium intake, the negative effect of lactation may be spontaneously compensated provided the mothers have better body weights and BMI’s. The link between bodyweight and BMI with peak bone mass would be further explored in future studies.