Original Article

Vitamin D deficiency in breast fed infants and their mothers in Islamabad, Pakistan

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Objective: To look at 25-(OH) vit D status in infants and their nursing mothers to examine maternal and infant factors in relation to infant 25-(OH) vit D status.

Methodology: This cross-sectional descriptive study was conducted in Pediatric department of Shifa Falahee Health Center, a part of Shifa International Hospital, Islamabad, Pakistan from July 2012 to July 2013. A total of 150 participants, 75 infants aged 4-12 months and their nursing mothers were enrolled. Details of infants and mothers were recorded. Serum 25-(OH) vit D of infants and mothers along with serum calcium, phosphorus and alkaline phosphatase were estimated. Radiographs left wrist of infants were taken.

Results: Vitamin D deficiency was found in 66.6% of infants and 36% of mothers; and insufficiency in an additional 12% of infants and 58.7% of mothers. 8% of infants and 36% of nursing mothers had 25-(OH) vit D levels below 3ng/ml and necessitated supplementation. 18.6 % of infants and 2.7% of nursing mothers had sufficient levels of 25-(OH) vit D.

Conclusion: Low 25-(OH) vit D levels were very common amongst exclusively breastfed infants and nursing mothers in Islamabad, Pakistan. Studies with large sample need to be performed in different parts of country to confirm these findings. Breastfed infants and their mothers should be supplemented with 25-(OH) vit D. (Rawal Med J 2014;39: 452-455).

Key words: Vitamin D deficiency, breast fed infants, 25-(OH) vit D levels.

INTRODUCTION

Rickets was first described in the 17th century and Vit D deficiency (VDD) was recognized as the underlying cause of this disease.[1,2] For most individuals, exposure to sunlight is the most important source of vitamin D, with foods alone being an inadequate source to fulfil the requirements of vitamin D in the body.[3,4] Pregnant and nursing mothers and their exclusively breastfed infants are affected adversely by VDD. During the first two months of life, serum levels of 25-(OH) vit D in infants are dependent upon the 25-(OH) vit D status of mothers at the time of the infant's birth. Subsequently, the only source of 25-(OH) vit D for infants is their mother's milk.[5]

In Pakistan, VDD has become a major health problem.[6] In South East Asia, rickets prevails in 15-18% of the population.[7] However, different studies carried out provide evidence of VDD in the country. In Pakistan, prevalence of 70-97% has been reported in healthy asymptomatic volunteers in two different studies from Agha Khan University, Pakistan.[8] A study from Norway among five immigrant groups from Iran, Sri Lanka, Turkey, Pakistan and Vietnam reported VDD.[9] In another study of the 55 mothers suffering from osteomalacia whose children were born with rickets, 24% were of Indian/Pakistani origin.[10]

A study from Agha Khan University, Karachi, Pakistan reported subclinical nutritional VDD in breastfed Pakistani infants less than 3 months of age and their nursing mothers.[11] Pakistan Demographic and Health Survey 2012-13 indicated that exclusive breastfeeding for the first 6 months is 38% in Pakistani infants.[12] A study from Karachi, Pakistan, using serum calcium, phosphorus and alkaline phosphatase as indicators of vitamin D status, showed that rickets was more common in breastfed children compared with those who were given formula feed (85.3% vs. 40%).[13]

The World Health Organization (WHO) recommended in 2001 that exclusive breastfeeding should continue until 6 months of age to reduce infant's morbidity and mortality associated with

gastroenteritis.[14] Infants who are not weaned until 6 months of age are at a greater risk of micronutrient deficiencies.[15,16] Due to low vitamin D in milk, exclusively breastfed infants are at higher risk of VDD than formula fed infants.[17] Moreover, the mother needs much higher doses (100ug or 4000 IU per day of vitamin D) to achieve adult normal 25-(OH) vit D levels in her exclusively breast fed infant while low dose of supplements administered directly to the infant can achieve vitamin D sufficiency.[18-21]

Pakistan has no policy on the vitamin D supplementation of 'low-risk' breastfed infants. American and Canadian Academy of Pediatrics recommend to supplement breastfed and partially breastfed infants with 400 IU/day of vitamin D beginning in the first few days of life.[22] The aim of this study was to look at 25-(OH) vit D status in infants and their nursing mothers.

METHODOLOGY

The cross-sectional descriptive study was conducted in Shifa Falahee, a part of Shifa International Hospital, Islamabad, Pakistan from July 2012 to July 2013. Ethics Committee of the institute approved the study and Informed Consent from parents or legal guardians was taken. Total of 150 participants, 75 infants (4-12 months of age) and their nursing mothers were enrolled. Infants with hepatic and renal diseases or on anticonvulsant medicines were excluded from the study. The calculated sample size for an anticipated prevalence of 25-(OH) VDD of 80 per cent to fall within 10 per cent of the true prevalence with 95 percent confidence was 256. However, because of logistic constraints, it was planned to enroll 75 mothers and infants. A convenience sampling strategy was used.

A questionnaire was drafted and was pilot tested. The information was collected on maternal history including age, ethnic background, education, occupation, diet, type of housing, exposure to sunlight, purdah (external garment covering the entire body, and may include the face too), number of pregnancies, muscle fatigue, bone pains, muscle cramps, joint pains, and vitamin D supplementation. A detailed history from the mothers was taken regarding infant's age, gender, number of siblings, order of birth, exposure to sunlight, type of housing, clothing, breast feeding, mode of delivery, history of infections, motor milestones and examination of infant for grade of malnutrition, skin tone, muscle tone, widening of wrists, rickety rosary, frontal bossing, Harrison's sulcus and pallor. Infant's radiographs of left wrist were taken.

Serum 25-(OH) vitamin D, calcium, phosphorus and alkaline phosphatase levels along with infant's radiographs of left wrist were taken. Serum 25-(OH) vit D level of mothers was also measured. The data were analyzed using SPSS v. 17.00.

RESULTS

Vitamin D deficiency was found in 66.6% of infants and 36% of mothers; and insufficiency in an additional 12% of infants and 58.7% of mothers. 8% of infants and 36% of nursing mothers had 25-(OH) vit D levels below 3ng/ml and necessitated supplementation (Table 1).

Table 1. Prevalence of vitamin D deficiency in infants and mothers (n=75).

Parameter	Infants n (%)	Mothers n (%)
Severe vitamin D deficiency ≤ 3.5ng/ml	6 (8%)	27 (36%)
Vitamin D Deficiency <20ng/ml	50 (66.6%)	44 (58.7%)
Vitamin D Insufficiency 21-29ng/ml	9 (12%)	2 (2.7%)
Vitamin D Sufficiency >30ng/ml	10 (18.6%)	2 (2.7%)

In 7% of infants, skeletal deformities were detected clinically, and radiological findings were subtle. This was in the form of metaphyseal widening. The mean serum 25-(OH) D in infants was 17.05±14.425ng/l. Mothers' age was between 19 to 37 years (mean age of 27.20±0.46). Numbers of children of participants were 1 to 5 (mean 2±1.28). 89.3% of infants had low serum calcium levels (normal: 10-12 mg/dl) and 13.3% had low serum phosphorous levels (normal: 4-7mg/dl). In 82.6% of infant's serum alkaline phosphatase level were raised (normal: 545U/L) (Table 2). Majority (65.3%) of the women were of Punjabi origin. Family income did not exceed 300 US dollar/month.

82.7% of the women were housewives whereas the remaining (17.3%) were either self-earners or employed. 17.3% of the mothers were uneducated, 82.7% were educated. All mothers had limited sunlight exposure and 70.7% of mothers wore veil.

Table 2. Biochemical markers in infants (n=75).

Parameter	Infants n (%)
Hypocalcemia	(89.3%)
Raised ALP	(82.6%)
Serum Phosphorous	(82.6%)

ALP: alkaline phosphatase

None of the participants used vitamin D fortified foods. Therefore, for the purpose of research, we included data on the consumption of eggs only, as compared to other naturally occurring nutritional sources. 62.7% of the participants gave a history of eating two eggs /week whereas 37.3% did not consume eggs in any form. 78.7% participants took supplementations prescribed to them during pregnancy. In Pakistan, pregnant women are supplemented with folic acid during the first trimester. Calcium and iron are started from the second trimester. 69.3% women had complaints of muscle fatigue, bone pains and muscle cramps. 9.3% complained of muscle fatigue alone. 2.7% had symptoms of only bone pains and another 2.7% had muscle cramps alone. Majority (49.3%) lived in a single room house. 48% women lived either in a two or three room house. Participants (Nursing mothers and infants) were counselled and/or supplemented with vitamin D by physicians depending on their 25-(OH) vit D3 levels.

DISCUSSION

Vitamin D deficiency was found in 66.6% of infants and 36% of mothers; and insufficiency in an additional 12% of infants and 58.7% of mothers. 8% of infants and 36% of nursing mothers had 25-(OH) vitamin D levels below 3ng/ml and necessitated supplementation. Our finding of a direct correlation between the 25-(OH) vitamin D levels of mothers and their infants indicates that 25-(OH) VDD existed in nursing mothers and the infants. This is consistent with previous Pakistani studies.[8,11-13]

Factors that lead to VDD in infants include low levels of vitamin D in the mother, prolonged breastfeeding, lack of adequate sun exposure due to living indoors or at high altitudes, and covering up the body when outside, leading to low presence of sunlight. Having a concentration of <20 IU/l in breast milk, the low levels of vitamin D are insufficient to meet the requirements of the growing infant.[2,3] Therefore, exclusively breastfed infants are at a higher risk of developing VDD, especially because mothers were mostly housewives, and confined their infants indoors.

We endorse breastfeeding for all infants. However, breast milk is a poor source of vitamin D. We suggest screening and vitamin D supplementation of nursing mothers and breastfed infants in preventing 25-(OH) VDD, particularly in infants who may be at higher risk due to limited sun exposure and exclusively breast-feeding.

CONCLUSION

Low 25-(OH) vitamin D levels are very common amongst exclusively breastfed infants and nursing mothers we studied. A program for screening and treating nursing mothers at high risk of VDD should be implemented. The physicians should routinely counsel nursing mothers on adequate 25-(OH) vitamin D intake. Exposure of women and infants to sunlight should be encouraged. Breastfed infants should be supplemented with vitamin D for the first 12 months of life. Studies with large sample need to be done in different parts of country to confirm these findings.

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