ORIGINAL ARTICLE

Vitamin D Levels Among Pregnant and Lactating Women

Saima Sharif[1], Tasnim Farasat[1], Hamna Shoaib[1], Muhammad Saqib[2] and Sabiha Fazal[1]

ABSTRACT

Objective: To assess the serum level of vitamin D in pregnant and lactating women.
Study Design: Case-control study.
Place and Duration of Study: Gynaecological Unit 1 of Jinnah Hospital, Lahore, from December 2010 to May 2011.
Methodology: A total of 100 women comprised of three groups: pregnant (n = 40), lactating (n = 40) and control (n = 20) groups. The information regarding age, educational level, socioeconomic status, exposure to sunlight and dietary vitamin D intake were collected through self-structured questionnaire. Serum concentration of vitamin D was measured by ELISA and serum calcium and phosphate levels were measured by chemistry analyzer. Statistical analysis was done using SPSS (version 13). The values were considered significant at 0.05 level of significance.
Results: The mean serum vitamin D level in the pregnant and lactating mothers was 26.5 ± 17.1 nmol/L and 21.4 ± 16.3 nmol/L respectively and in control group was 33.8 ± 21.1 nmol/L. The mean calcium level in the pregnant, lactating and control group was 10.3 ± 1.2 mg/dL, 9.7 ± 1.3 mg/dL and 9.7 ± 1.3 mg/dL respectively. The mean phosphate in pregnant was 3.2 ± 0.76 mg/dl, in lactating was 3.3 ± 0.76 mg/dl and in control was 3.5 ± 0.92 mg/dl. Significant difference (p = 0.041 and p = 0.037 respectively) in the serum levels of vitamin D and calcium was observed among the pregnant and lactating women as compared to control group.
Conclusion: Low serum vitamin D concentration was observed in lactating women and pregnant women as compared to control group.

Key Words: *Vitamin D. Pregnancy. Lactation. Calcium. Phosphate.*

INTRODUCTION

Maternal vitamin D status during pregnancy is necessary for the skeletal composition and development of fetus. Low maternal vitamin D is associated with shorter duration of gestation and consequently reduced growth of long bones in newborns.[1] The primary role of vitamin D is to maintain serum phosphate and calcium levels by promoting their intestinal absorption directly, or by activating bone resorption through indirect recruitment and activation of osteoclasts.[2]

Vitamin D sufficiency is more critical during pregnancy and lactation. Calcium absorption increases during pregnancy in response to fetal demands, thus, increasing the level of vitamin D. Pregnant women should consume 10 times more vitamin D than normal women.[3] The new born consumes its vitamin D stores in the first 8 weeks. If vitamin D deficiency continues during lactation, the risk of rickets increases in breastfed infants. 1, 25 (OH) 2D levels are increased from the beginning of pregnancy.[4] Vitamin D is crucial for the absorption and metabolism of calcium and phosphorous.

During pregnancy, mostly in the last trimester, changes in maternal vitamin D and calcium metabolism allow the transfer of upto 250 mg of calcium per day to the fetal skeleton, for a total of 25 – 30 grams of calcium.[5] The doubling of intestinal calcium absorption starts in the first trimester of early human pregnancy and remains increased in all trimesters.[6,7] Vitamin D deficiency is associated with osteoporosis and a variety of other illnesses, ranging from depression and severe myopathy to autoimmune disease in adults and rickets, infant heart failure, acute lower respiratory tract infection[3] and improper bone development at 9 years in children.[1,5]

It has been estimated that 1 billion people worldwide have vitamin D deficiency or insufficiency.[8] About 70 – 90% of vitamin D deficiency has been identified in healthy asymptomatic volunteers in two studies conducted in Karachi.[9]

The objective of this study was to assess the serum concentration of vitamin D, calcium and phosphate levels in pregnant and lactating women.

METHODOLOGY

A case-control study was conducted among women visiting the Gynaecological Unit I of Jinnah Hospital, Lahore, from December 2010 to May 2011.

A total of 100 women aged 20 – 40 years were included in the study. Sample size was calculated by using sample calculator on Raosoft with 95% confidence level, 9% margin of error and taking expected percentage of vitamin D deficiency as 70% in subjects.

In pregnant group (n = 40) subjects with second or greater gravida in third trimester of pregnancy (pregnant)

[1] *Department of Zoology, Lahore College for Women University, Lahore.*
[2] *Medical Unit 01, Jinnah Hospital, Lahore.*

Correspondence: Dr. Saima Sharif, Department of Zoology, Lahore College for Women University, Jail Road, Lahore.
E-mail: ssharif1978@yahoo.com

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were included and lactating group (n = 40) women belonging to same socioeconomic status with second or greater parity (lactating) were included. A control group (n = 20) comprised of unmarried women of age 20 – 25 were also included. All the subjects completed a questionnaire that had information about the subject's age, educational level, socioeconomic status, life style, exposure to sunlight and use of any supplements related to calcium and vitamin D and approximate dietary vitamin D intake. Women with gestation below third trimester and less than 5 months of lactation were excluded from the study. Any subject using the supplements related to calcium and vitamin D were excluded from the study. Educational level was categorized as illiterate-elementary, school graduate and graduates. Socioeconomic status was categorized as Low Class and Middle Class. Dietary vitamin intake was considered low if less than 100 IU/day and normal if greater than 100 IU/day.[10] Daily sun exposure was divided into two groups, < 1 hour/day and > 1 hour/day. Vitamin D level less than 30 nmol/L was considered as deficient and between 30 – 50 nmol/L as insufficient and greater than 50 nmol/L as sufficient.[11]

Vitamin D was assessed by ELISA, calcium level and phosphate were assessed by chemistry analyzer in the Central Science Laboratory of LCWU.

The statistical analysis was then conducted on the data using statistical software package SPSS version 13. The comparison of three groups was performed by ANOVA. The values were considered significant at 95% of confidence interval.

RESULTS

The demographic data of the 100 participants is shown in Table I. The mean value of vitamin D, calcium and phosphate in control, pregnant and lactating women were presented in Table II. Vitamin D and calcium showed significant difference among the groups (p = 0.041 and p = 0.037 respectively). In pregnant group, deficiency was observed in 50 %, insufficiency was in 45% and only 5% had sufficient levels of vitamin D. In lactating group, 2.5% had sufficient levels, 22.5% had insufficient levels and 75% had deficient levels of vitamin D. The prevalence of vitamin D deficiency in control group was observed in 40% and insufficiency in 45% and only 15% had sufficient levels of circulating vitamin. In the pregnant group, the level of serum calcium was highest as compared to control and lactating group.

No significant difference was observed in the serum concentration of phosphate among pregnant, lactating and control groups (p = 0.56).

DISCUSSION

The overall vitamin D deficiency among all our participants (n = 100) was 58% that is very high, similar rates have been reported in England.[12] The impact of this deficiency on the future health of vitamin D deficient mothers is evident. It is also evident on the future health of their offspring, since most Pakistani women breastfeed their infants for 1 – 2 years. The fetus is solely dependent on the mother for the supply of this vitamin D. The high level of illiteracy showed that most of the women were unaware of the diseases that can be caused by the deficiency of vitamin D and calcium.

In this study population, vitamin D levels were lying in insufficient range that is not consistent with the IOM Committee.[13] This study population included pregnant and lactating mothers and it underscores the need for the health of the neonates and the mothers. In present study groups, women had inadequate dietary vitamin D intake. Vitamin D supplementation is necessary for all pregnant and lactating women and it is critically essential in winter.

Important factors for deficiency are a lack of exposure to sunlight and poor diet. The city has intensive industrial air pollution, which prevents optimal exposure to sunlight. In addition to mothers' dressing habits, cultural restrictions, low dietary vitamin D intake, no vitamin supplementation during pregnancy, spending most of the day time at home contribute to vitamin D deficiency.

Most of the women in this study were from the middle socioeconomic status, whereas it was speculated that vitamin D deficiency was found in the low socioeconomic class.[14] In a study carried out in Pakistan, a high prevalence of vitamin deficiency was found in breastfed infants and nursing mothers, predominantly among those belonging to upper socioeconomic class.[15] This indicates the unawareness about the significance of vitamin D among public irrespective of their economic status.

If the exposure to sunlight is not optimal, the vitamin D content of the diet must be at least 400 IU/day, the places where sunshine exposure is low, 1000 IU/day should be given during the last 3 months of pregnancy or 100 000 IU in one dose at the beginning of the last trimester.[16]

The endogenous synthesis from sun exposure is an important source of vitamin D, but large seasonal variations in serum 25-hydroxyvitamin D concentrations have been observed in adults and infants.[17] In the present study exposure to sunlight was less than 1 hour/day in 69% of the women. Less sun exposure is one of the major causes of vitamin D deficiency in women especially in the winter months. Women in this study were mostly housewives, who spent most of their time in household chores and remained unexposed to the sun.

Direct exposure to ultraviolet radiation and dietary intake are the two main sources of vitamin D. Inadequate exposure to sunlight and less dietary intake during

Table I: Demographic data of pregnant, lactating and control women.

Demographic data	n	Pregnant	Lactating	Control
All Women	100	40	40	20
Age				
< 25 years	24	03	04	17
> 25 years	76	37	36	03
Educational level				
Illiterate-elementary	38	18	20	-
School graduate	24	14	10	-
Graduates	38	08	10	20
Socio-economic status				
Low	26	13	12	01
Middle	74	27	28	19
Dietary vitamin D intake				
< 100 IU/day	67	31	35	11
> 100 IU/day	33	09	15	09
Daily sun exposure				
< 1 hour/day	69	30	29	10
> 1 hour/day	31	10	11	10

Table II: Mean ± SD values of vitamin D, calcium and phosphate in pregnant, lactating and control groups.

Biochemical parameters	Pregnant n = 40	Lactating n = 40	Control n = 20	p-value ANOVA
Vitamin D (nmol/L)	26.5 ± 17.1	21.4 ± 16.3	33.8 ± 21.1	0.041*
Calcium (mg/dl)	10.3 ± 1.2	9.7 ± 1.3	9.4 ± 1.3	0.037*
Phosphate (mg/dl)	3.2± 0.76	3.3 ± 0.76	3.5 ± 0.92	0.56^{NS}

*$p < 0.05$; ^{NS} $p > 0.05$

pregnancy and lactation cause both inadequate body stores in the newborn and in breast-milk.[18] Vitamin D deficiency is less likely to develop in women residing in Pakistan due to the abundant sunshine available.[19]

The implications of the present findings are especially relevant in a community such as ours, where exclusive breastfeeding during the neonatal period is usual. In the absence of maternal vitamin D supplementation, exclusive breastfeeding of vitamin D-deficient babies by vitamin D deficient mothers allows vitamin D deficiency to continue in the population. This deficiency could easily be corrected by maternal supplementation with vitamin D, and if it is not corrected it could cause long-term detriment to the health of the children. On the basis of the present findings, universal screening and supplementation with vitamin D during pregnancy and lactation was recommended; the findings further emphasize a need for attention to vitamin D supplementation for the mother and the newborn, for lactating women, and for infants that are exclusively breastfed.

Pregnant women should be encouraged to expose themselves to sunlight especially in winters. Vitamin D supplementation should be provided to vitamin D deficient mothers nursing their children and to pregnant women. Fortification of certain foods with vitamin D will be a practical way of preventing maternal vitamin D deficiency and rickets in their infants. There is a need to give health education regarding sunshine exposure, modification of dietary habits by increasing the calcium intake, and daily supplementing all pregnant and lactating mothers with vitamin D.

The control group in this study comprised of young female students. The deficiency among them is supposed to be due to the use of sun-blocks, wearing veils, use of umbrella while going outside and unawareness of significance of vitamin D.

CONCLUSION

Significant low levels ($p = 0.041$) of serum vitamin D were observed in pregnant and lactating women. Forty percent of the young healthy females, 75% lactating and 50% of pregnant women were found deficient in vitamin D levels. The factors such as style of clothing, poverty, social and religious restrictions and insufficient vitamin-D intake are possible risk factors for vitamin D deficiency.

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