

# FREQUENCY OF HYPOVITAMINOSIS D IN MOTHERS OF RACHITIC INFANTS IN PESHAWAR

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## ABSTRACT

**Objective:** To determine the frequency of Vitamin D deficiency in lactating mothers of infants presenting with rickets

**Material and Methods:** This was a cross sectional descriptive study conducted at Biochemistry Department, Khyber Medical College Peshawar from October 2013 to January 2014. 100 breastfeeding mothers of infants (children beyond neonatal age) with nutritional or vitamin D deficiency rickets were included. Mothers of infants with nutritional rickets fed on formula milk wholly or partially and those with secondary rickets were excluded. Blood samples from mothers were collected in Khyber Teaching Hospital (KTH) and Hayatabad Medical Complex (HMC) Peshawar. All the analyses were performed on Semi-Automatic Clinical Chemistry Analyzer Metrolab 1600. 25-OH Cholecalciferol levels in the serum were determined by ELISA method.

**Results:** Hypovitaminosis D was found in 73% of breastfeeding mothers of infants with rickets. This included 26% of Vitamin D Deficiency and 47% of Vitamin D Insufficiency. Minimum level of 25-OH Vitamin D was 10ng/ml and maximum 58ng/ml with a mean value of 26.94 ng/ml. 71% of mothers with low Vitamin D status belonged to urban areas, 52% were uneducated, 56% were of the highest income group, 42% had a dress preference for being "unveiled" when outdoors, 19% had maximal exposure to sunlight, 73% had no vitamin D supplementation and 86% of such mothers with hypovitaminosis D were housewives. 44% low vitamin D status mothers were either obese or overweight. High serum Alkaline Phosphatase level was associated with hypovitaminosis D in 84% cases, low serum calcium found in 59% and high phosphate in 25% of mothers with low vitamin D status.

**Conclusion:** Breastfeeding mothers of infants with rickets are usually vitamin D deficient/having low vitamin D status.

**Key Words:** Hypovitaminosis D, 25 OH Vitamin D, Vitamin D insufficiency, Vitamin D Deficiency, Rickets.

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## INTRODUCTION

Vitamin D deficiency (VDD) is common throughout the world and has been recognized as a pandemic. Globally about one billion people are suffering from VDD or vitamin D insufficiency (VDI)<sup>1,2</sup>. Reduced sun exposure, dark skin and inadequate intake are the important causes<sup>3,4</sup>. VDD in breastfeeding mothers can play an

important role in causing infantile rickets<sup>5,6</sup>. The maternal association of infantile rickets is perhaps historical as Glisson stated about the rickets onset: "rarely invade children before they are six months old". His statement continued like that: "it then gradually affects children till they are two and peaks after that.<sup>6,7</sup> During breastfeeding, mothers need relatively greater amount of calcium to be passed on to the feeding infant. Knowing about the fact that the bone metabolism and concentration of calcium is dependent upon vitamin D, someone might expect that during lactation maintaining vitamin D sufficient status would be more critical. However, it has been shown that certain adaptations in hormonal and skeletal homeostatic mechanisms of breastfeeding mothers the calcium requirement is fulfilled relatively independently

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of maternal vitamin D status. Rather it is the infant with VDD or VDI who faces risk of developing rickets and other problems<sup>8,9</sup>. Vitamin D and 25-Hydroxy vitamin D (25 OH D) is poorly penetrated into milk; hence exclusively breastfeeding infants have a comparatively greater risk of VDD than bottle fed infants<sup>10</sup>. Serum 25(OH)D having a longer half-life is considered as the best indicator of vitamin D status in an individual<sup>11</sup>.

Recommendations for appropriate maternal Vitamin D dosages during lactation should be best directed in such a way that vitamin D-sufficiency in the neonate can be ensured and that such a status of vitamin D must be maintained during the following months in infancy and beyond<sup>9</sup>.

Breastfeeding exclusively or near to it for 6 months can lead to maternal loss of calcium much higher than that in pregnancy. One might anticipate that decreased intake of calcium and vitamin D would add to skeletal losses for maintaining calcium content of the breast milk; however it's not suggested by most studies. Breastfeeding doesn't confer any increased risk of fractures, low bone density, or osteoporosis<sup>12</sup>. Healthy breastfeeding women have peculiar findings in their blood chemistries; these include normal total serum calcium and ionized calcium concentrations, and serum phosphorus level above normal range, cause probably being enhanced skeletal resorption<sup>6</sup>.

### MATERIAL AND METHODS

After approval of the Ethical Committee of Khyber Medical College, Peshawar, a cross-sectional descriptive study was carried out in the Biochemistry Department, Khyber Medical College, Peshawar for determining vitamin D status of 100 breastfeeding mothers of infants (one to 12 months of age) with rickets due to vitamin D deficiency, chosen by non-probability convenience sampling, presenting to the Departments of Pediatrics, Khyber Teaching Hospital (KTH) and Hayatabad Medical Complex (HMC), Peshawar. Hypovitaminosis D for the study purpose was defined as "25 OH Vitamin D level below or up to 29 ng/mL". This included both the standard definitions of Vitamin D Deficiency (25 OH Vitamin D level < 20 ng/mL) and Insufficiency (25 OH Vitamin D level of 21-29 ng/mL).

Maternal residential status (rural or urban), dress preferences when outdoors, sunlight exposure, vitamin D supplementation and BMI were among other important determinants of maternal vitamin D status. Mothers of infants with rickets not being breastfed, of neonates (children less than age 30 days) with hypocalcemia due to vitamin D deficiency or congenital rickets and of infants with rickets due to cause other than vitamin D deficiency were excluded.

Anthropometric indices of both mother (weight, height and Body Mass Index) and infant (weight, height and occipitofrontal circumference (OFC) were recorded. Relevant investigations, performed on the infant in the

wards or done as outpatient, as per advice of doctors in the Pediatrics department including serum calcium, serum phosphorus and serum alkaline phosphatase and/or radiographs of the infant's wrist joint, were obtained from the ward record (admitted infants) or from the parents (in case of outpatient cases) and noted. All the information was recorded on a proforma and proper consent taken.

Blood samples were collected from each mother and brought to Research Laboratory, Biochemistry Department of Khyber Medical College, Peshawar. Serum was collected by centrifuging the blood samples at 3000 rpm for 5 minutes. Fresh samples of serum were used for determination of calcium, alkaline phosphatase and phosphorus. The remaining portion of serum samples were kept in a refrigerator for finding 25 (OH) D levels by ELISA at a later stage when 100 samples were collected and complete. Serum calcium, alkaline phosphatase and phosphorus were measured by using colorimetric method. All the analysis was done using Semi-Automatic Clinical Chemistry Analyzer Metrolab 1600.

This was a descriptive study, so no inferential statistics and tests of significance were applied. Different variables were considered using descriptive statistics like mean, standard deviation, percentages and proportion for qualitative data. Data was analyzed on computer using software package SPSS.

### RESULTS

Out of 100 breastfeeding mothers of infants with rickets, 27% had adequate or sufficient vitamin D, 47% were vitamin D insufficient and 26% had vitamin D deficiency. In other words, 73% of the mothers had hypovitaminosis D. Among the rachitic infants whose mothers were studied for vitamin D status, 56% were male and 44% female; minimum age among the infants was 3 months and maximum age was 11 months, with a mean of 7.54 months. Minimum age amongst all the studied mothers was 17 years and maximum 35 years with a mean of 25.82 years.

31% of mothers studied belonged to rural and 69% to urban areas. Among 31 mothers of infants with rickets belonging to rural area, 21 (73%) cases which comprised 17 (45%) cases of insufficiency and 4 (28%) cases of deficiency while among 69 mothers from urban area, 52 (75%) cases had hypovitaminosis D comprising 30 (43%) cases of vitamin D insufficiency and 22 (32%) of vitamin D deficiency. 33% mothers had minimal, 40% moderate and 27% maximal exposure to sunlight. Regarding exposure to sunlight, hypovitaminosis D was found in 29 (88%) minimally exposed, 30 (75%) moderately exposed and 14 (52%) maximally exposed to sunlight among 33, 40 and 27 mothers having infants with rickets. Among 57 mothers whose dress preference was veiled when outdoors, hypovitaminosis D was found in 42 (73%) with 26 (45%) being vitamin D

## Frequency of hypovitaminosis d in mothers of rachitic infants in Peshawar

**Table 1: Frequency of Hypovitaminosis D among mothers (n =100) according to their occupation and Vitamin D supplementation during pregnancy**

Parameter	Vitamin D status of mother				Total
	Vitamin D Sufficiency	VDI (A)	VDD (B)	Hypovitaminosis D (A + B)	
<b>Vitamin D intake during pregnancy</b>					
Yes	5 (38%)	4	4	8 (62%)	13
No	20 (28%)	36	17	53 (72%)	73
Do not know	2 (14%)	7	5	12 (86%)	14
Total	27	47	26	73	100
<b>Occupation of Mother:</b>					
Housewife	25 (28%)	41	22	63 (72%)	88
Employed	2 (17%)	6	4	10 (83%)	12
Total	27	47	26	73	100

insufficient and 16 (28%) vitamin D deficient. Out of 43 mothers with unveiled dress preference when outdoors, 31(72%) had hypovitaminosis D which comprised 21 (49%) cases of vitamin D insufficiency and 10 (23%) cases of vitamin D deficiency. Among 13 mothers who took vitamin D as a supplement during pregnancy, 73 mothers who didn't and 14 those who were unaware of their use of vitamin D as supplementation, hypovitaminosis D was present in 8 (62%), 53 (72%) and 12 (86%) cases respectively. Hypovitaminosis D was also found in 63 (72%) and 10 (83%) cases among 88 housewives and 12 employed mothers respectively. Body mass index with hypovitaminosis D in relation to occupation and Vitamin D supplementation is shown in Table 1.

High serum ALP level was associated with status of hypovitaminosis D in 61 (83%) and normal level in 12 (44%) cases. Low serum calcium was found to be associated with hypovitaminosis D in 43 (67%) while normal level in 30 (83%) cases. Vitamin D status of mothers of infants with rickets was hypovitaminosis D in 10 (77%) out of 13 cases with a low serum Phosphate level, 45 (69%) out of 64 with a normal and 18 (82%) out of 22 cases with high serum phosphate level.

### DISCUSSION

Hypovitaminosis D continues to be a problem from public health point of view with a high prevalence in many countries of Asia despite frequent sunshine and abundant sunlight<sup>13-15</sup>. Maternal hypovitaminosis D is not considered as uncommon in Pakistan<sup>16</sup>. Further, rickets in infants that results from nutritional deficiency of vitamin D is well documented. It has also now become clear that a positive correlation exists between maternal status of vitamin D during pregnancy and breastfeeding and the development of rickets in infants as well as toddlers and children<sup>17</sup>. A recent study has elucidated that maternal status of vitamin D is a very important factor in ascertaining the status of vitamin D of the infant and

the latter's risk of development of vitamin D deficiency and nutritional rickets.<sup>18</sup>

Despite its descriptive nature and not being a comparative one, this study still demonstrates that majority of the mothers who were breastfeeding and presented to two local tertiary care hospitals with their rachitic infants were themselves suffering from hypovitaminosis D. Maternal factor has been proved in the pathogenesis of rickets in infants in the studies from various countries. Nozza from Australia observed that 81% mothers of rachitic infants had 25-OHD concentrations less than 25nmol/L, the levels conforming to osteomalacia<sup>19</sup>. Rickets was reported by Pillow et al in infants of immigrant mothers who had vitamin D deficiency<sup>20</sup>. It was found in USA that vitamin D deficiency was present in half of mothers and two third of their infants. 25-OH D concentrations of both mothers and infants were positively correlated which indicated that vitamin D deficiency in mothers may be considered as risk factor leading to rickets in children<sup>21</sup>. It was reported in Egypt that vitamin D deficiency was common in lactating mothers of infants having being diagnosed with rickets<sup>22</sup>. Similarly in India Vitamin D deficiency was found in exclusively breastfeeding infants and their mothers<sup>23</sup>. Orbak et al from Turkey reported eight infants presenting with seizures due to hypocalcemia were subsequently diagnosed as rickets while their mothers were found to have osteomalacia. Vitamin D was supplemented neither to mothers nor to their infants. Causes of rickets in these infants were vitamin D deficient mothers and non-supplementation of vitamin D to the infants<sup>24</sup>.

In United Arab Emirates 92% of children with rickets and 97% of their mothers had Vitamin D deficiency as compared to 52% of mothers having 22% of non-rachitic children. Maternal vitamin D levels and those of children were positively correlated. The writers concluded that mothers of rachitic children should be investigated and treated for vitamin D deficiency<sup>25</sup>.

**CONCLUSION**

Rachitic infants have their mothers with low levels of 25OHD in their serum.

**RECOMMENDATIONS**

Small doses of vitamin D given directly to the infant will help prevent rickets while supplementing the breastfeeding mother with appropriate daily dose of vitamin D can also help maintain normal concentrations of 25(OH)D in infants.

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**AUTHOR'S CONTRIBUTION**

Following authors have made substantial contributions to the manuscript as under:

- Nawaz S:** Idea & data collection and typing.
- Rehman SU:** bibliography.
- Nawaz R:** Bibliography.
- Tariq K:** Data collection.
- Khan MA:** Supervision.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.