

**Study of Maternal and socio economic factors in relation with low Vitamin D levels in Infant**

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**Abstract**

**Introduction:** Vitamin D stores in children depend on the levels of vitamin D stores of the mother. If mother is deficient of vitamin D, children’s will be the deficient of the same. Restricted intake of vitamin D, insufficient exposure to sunlight was found to be the main reasons for vitamin D deficiency in the mother and women with dark skin pigmentation were also at higher risk. During the first 6-8 weeks of life, the vitamin D status of infants is determined by the vitamin D levels at birth, which depend on the vitamin D status of the mother. Breast milk concentration of vitamin D is low (<20 IU/l) and is inadequate for the needs of the growing infant. This implies that babies born to mothers with vitamin D deficiency are very likely to develop vitamin D deficiency unless supplemented from outside or adequately exposed to sunlight.

**Methods:** This prospective observational study was conducted in Infants in Indira Gandhi Government

Medical College, Nagpur. 86 infants were enrolled in the study who were visiting Immunization center, Outpatient Department (OPD) for routine checkup. Various maternal parameters, birth details of infants were noted. Serum 25 hydroxy vitamin D (25 OHD) and alkaline phosphates (ALP) levels were done in infants.

**Results:** Out of 86 Infants, 66 (76.7%) were found to be deficient, 8(9.3%) were found to be insufficient, and 12(14%) were found to be normal. but for statistical purpose deficient and insufficient infants 74(86%) were considered as deficient. Maternal risk factors like wearing burqa, dark complexion, sun exposure, economic status and religion were found significantly associated with low of Serum 25 hydroxy vitamin D (25 OHD) in infants. Also Means low value of Sr.25-OH Vit D3 is associated with high Value of Sr.Alkpo4 or vice a versa.

**Conclusions:** Prevalence of 25 hydroxy vitamin D Deficiency is 77 % were observed in exclusively breast

fed Infants and maternal risk factors like economic status, religion, occasional sun exposure, wearing burqa, dark complexion, were significantly associated with low level of 25 hydroxy vitamin D in Infant.

**Key words:** Maternal socio - economic status & social behavior, exclusive breast feeding, 25 hydroxy vitamin D deficiencies in infants.

### Introduction

Exclusive breast-feeding is recommended up to 6 months of age with all its beneficial effects on child survival. Globally as many as 1.45 million lives are lost due to suboptimal breast-feeding in developing countries. The increase in the practice of breast-feeding, associated with the belief that “breast is best” and that breast milk does not require supplementation because it is a baby’s “perfect food,” may lead to decreased 25-hydroxy vitamin D(25-OHD) intake from other sources and thereby causing rickets<sup>[1]</sup>.

Vitamin D is the essential precursor of 1, 25-hydroxyvitamin D, the steroid hormone required for calcium absorption, bone development and growth in children<sup>[2]</sup>. Vitamin D stores in children depend on the levels of vitamin D stores of the mother. If mother is deficient of vitamin D, children’s will be the deficient of the same<sup>(3)</sup> Restricted intake of vitamin D, insufficient exposure to sunlight was found to be the main reasons for vitamin D deficiency in the mother and women with dark skin pigmentation were also at higher risk<sup>(4)</sup> During the first 6-8 weeks of life, the vitamin D status of infants is determined by the vitamin D levels at birth, which depend on the vitamin D status of the mother. Breast milk concentration of vitamin D is low (<20 IU/l) and is inadequate for the needs of the growing infant. Vitamin D in breast milk relates to mothers’ vitamin D intake, skin pigmentation and

sunlight exposure. This implies that babies born to mothers with vitamin D deficiency are very likely to develop vitamin D deficiency unless supplemented from outside or adequately exposed to sunlight<sup>[5]</sup>. Against this background we planned a study with objectives to study the prevalence of vitamin D deficiency in exclusively breastfed **Infants** and association of various Maternal risk factors with low level of 25 hydroxy vitamin D in infants.

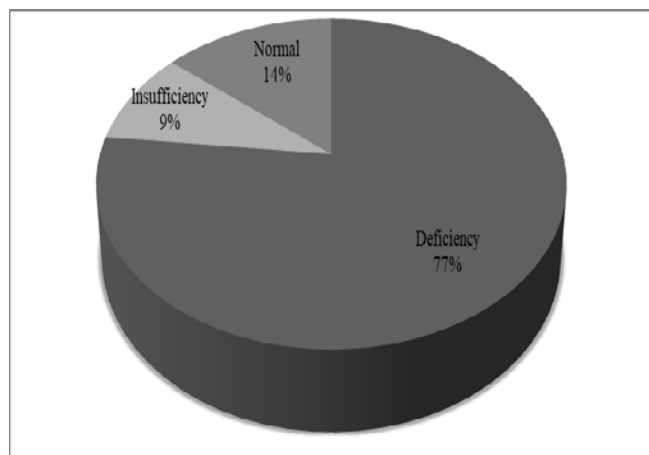
### Methods

The present study is observational study which is carried out in Department of Pediatrics Indira Gandhi Government Medical College, Nagpur from January 2019 to March 2020. Institutional ethical committee approval was obtained. Infants visiting Immunization center and Out Patient Department (OPD) for routine checkup were enrolled who fulfill the inclusion criteria. Total number of infants enrolled was 86. Sample size was calculated by expected prevalence of the event in the study group , $p= 0.667$ , expected absolute allowable error in the  $d = 0.10$  value of normal deviate at  $Z_{1-\alpha/2} = 1.96$ , 95% level of confidence,  $n = \{ Z_{1-\alpha/2} P(1-P) \} / d^2 = \{ (1.96)^2 \times (0.667)(1-0.667) \} / (0.10)^2 = 85.86 = 86$ , Sample size is minimum 86 of either sex. Exclusively full term breastfed infants without vitamin D supplementation were included in this study. Preterm infants(<37 weeks) , babies who are not exclusively breastfed, infants those received vitamin D supplementation and presence of chronic diseases in mother , any gross congenital anomaly in infants leading to feeding problem or illness requiring hospitalization in neonatal period were excluded. Use of glucocorticoids and vitamin D deficiency secondary to illness of vitamin D metabolism in mother during pregnancy were also excluded.

An informed consent was obtained from the parents of infants who were enrolled in the study. Eligible infants underwent detailed history including maternal risk factors like age, BMI, Parity, wearing burqa, drink milk, consumption flesh food or not, supplementation of vitamin D in pregnancy, color of skin, occupation of mother, religion, sun exposure, education of mother, economic status of family & Clinical examination of infants were recorded in case report form. After taking informed consent and proper counseling of parents blood sample of infants taken in plane bulb to estimate Sr.25H Vit D3 levels and ALP levels. Vitamin D deficiency was defined as 25OHD < 15 ng/ml, severe vitamin D deficiency as 25OHD <5 ng/ml and insufficiency as 25OHD 15-20 ng/ml. [Alkaline phosphatase in IU/L at 37°C (98.6°F) using p-nitrophenol phosphate buffered with 2-Amino-2 Methyl-1- Propanol (AMP) kinetic in infants is 145 - 420 IU/L. [7].

**Results**

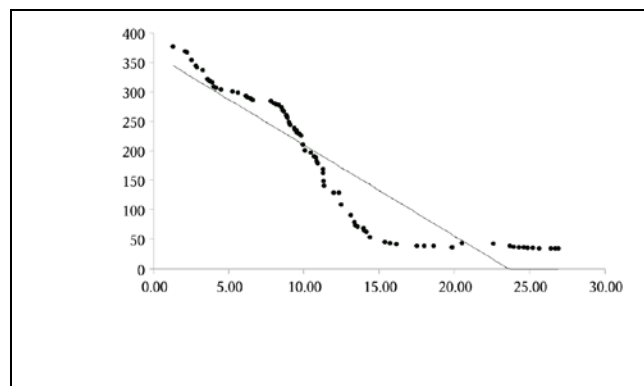
Figure 1: Prevalence of vitamin D deficiency in full term exclusively breastfed infants.



In Fig.1 Out of 86 infants, 66 (77%) infants were found to be deficient, 8 (9%) infants were found to be insufficient, and 12 (14%) infants were found to be normal. For statistical purpose deficient and

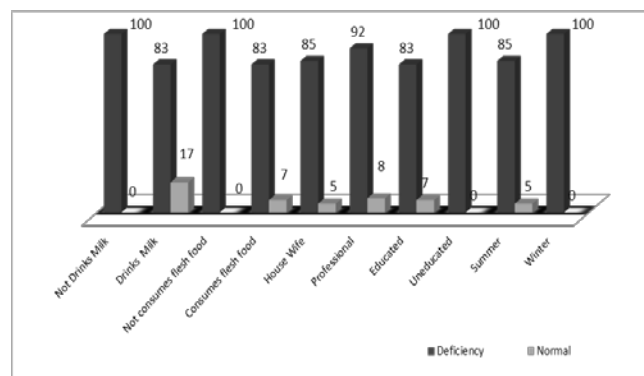
insufficient infant 74(86%) were considered as deficient.

Figure 2: Diagram showing correlation between 25-OH Vit D3 (ng/mL) and Alkpo4 (IU/L)



Significant correlation was found in our study. Correlation coefficient (r) was found to be -0.91602, and p = 0.0000 (<0.05). Significant correlation between 25-OH Vit D3 (1.30-26.92) and Alkpo4 (36-378) means low value of Sr.25-OH Vit D3 is associated with high Value of Sr.Alkpo4 or vice versa (fig 2).

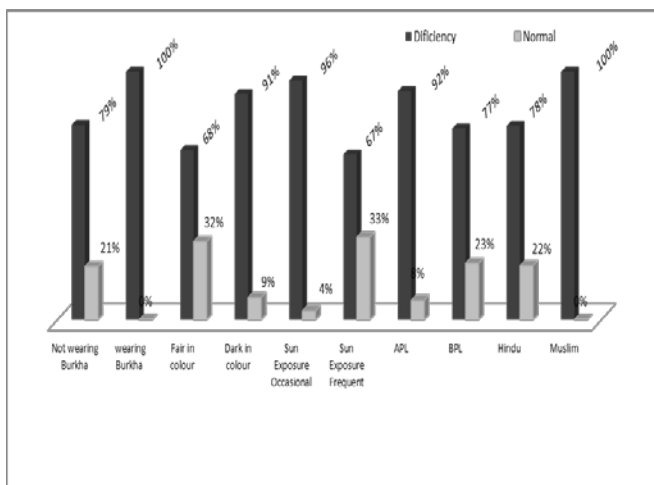
Figure 3: Diagram showing association between maternal risk factors and vitamin D (25 OHD3) (ng/mL) levels in Infants, deficient vs normal (Statistical non-significant)



Above maternal parameters which do not have the effect on vitamin D levels in infants like maternal education, working status, seasonal variation, consumption of milk and flesh foods found to be statistical non-significant. Neonates whose mothers

consume flesh food and drinks milk were found to be less deficient in 25 OH Vit D3 as compare to neonates whose mothers did not consume flesh food and not drink milk. Fisher Exact test.(  $p = 0.1675$ ). Also no significant difference found in parent's education. Fisher Exact test. ( $p=0.1392$ ), Parents occupation. Yates's corrected chi square = 0.02454. ( $p=0.8755$ ) and seasonal variation. Fisher Exact test. ( $p = 0.9251$ ) (Fig.3)

Figure 4: Diagram showing association between maternal risk factors with vitamin D (25 OHD3) (ng/mL) levels in Infants, deficient vs normal (Statistical significant factors)



Above maternal parameters which have the effect on vitamin D levels in infants like wearing burqa, dark complexion, sun exposure, economic status and religion were found to be statistical significant. Infants of mothers those are dark in complexion were found to be more deficient in 25 OH Vit D3 as compare to infants whose mothers had fair color. Yates's Corrected Chi Square = 4.567 ( $p = 0.006$ ). Also infants in Muslim community were more deficient in 25OHD as compare to infants of Hindu community. Fisher Exact test. ( $p= 0.00573$ ). Deficiency of 25OHD in infants of mother those were exposed to sun more

frequently was found to be less as compared to those expose to sun occasionally. Yates's Corrected Chi Square = 12.04. ( $p = 0.0005208$ ). Deficiency of 25OHD in infants of mother those wearing burqa is found to be more as compare to those were not wearing burqa. Fisher Exact test. ( $p=0.007304$ ). Neonates whose parents from lower socioeconomic class or from Below Poverty Line (BPL) found to be less deficient in 25OHD as compare to those from upper socioeconomic class or from Above Poverty Line (APL) . Pearson's Chi Square = 3.89. ( $p = 0.048$ ). (Fig.4)

### Discussion

In this study we found prevalence of vitamin D deficiency is 77% in exclusively breastfed infants. Out of 86 neonates, 66 (77 %) have deficiency of 25 OH Vit D3.

Indian study by Agrawal M et al (2003), shows that out of 78 infants 82% had Hypovitaminosis D and had elevated serum alkaline phosphates [8]. Study done by Vandana Jain et al from New Delhi, India (2011) showed out of 98 infants 66.7% was found to be having deficiency of 25 OH Vit D3. Study done in Pakistan by Atiq M,Suria A et al (1998) shows high prevalence of Vitamin D deficiency in 62 healthy breastfed infants which was 55% [9]. This incidence is much higher than the studies done by other European and American investigators like S H Dijkstra et al (2007), Netherland suggest out of 87 newborns of healthy mothers the prevalence of vitamin D deficiency was 42.5% [10]. In a Study done by frank R Greer (2008) American Society for Clinical Nutrition out of 40 breastfeeding infants 30% had low level of 25 (OH) D concentrations [11].

We found that deficiency of 25 OH D in infants of mother those were exposed to sun more frequently (67%) is found to be less as compared to those mother who expose to sun occasionally (96%).

Study done by Ozkan B et al (2005) in Turkey suggests out of 42, 29 infants (69%) had Hypovitaminosis D. Most infants (83%) were exclusively breast-fed without supplemental vitamin D. All mothers had limited sunlight exposure and 33 of 42 mothers (78.6%) were concealing clothing<sup>[12]</sup>. Since vitamin D is principally derived from the action of sunlight on exposed skin, inadequate exposure to sunlight, leads to vitamin D which must be made up from dietary sources. In exclusive breast fed babies as the content of breast milk vitamin D is low, so vitamin D deficiency was aggravated.<sup>[13]</sup>

We found that infants whose mothers were dark in color found to be more deficient (92%) in 25 OH Vit D3 as Compare to infants of fair colored mother (65%). We found that deficiency of 25OHD in infants of mother wearing burkha (100%) is found to be more as compared to those not wearing burkha.

Study done by S H Dijkstral et al (2007), suggest out of 87 infants of healthy mothers with either dark skin and/or concealing clothing (risk group) had higher prevalence of vitamin D deficiency (63.3%) as compared with light skin (control group) (15.8%). In addition, the new born infants of the veiled mothers (dark skin) showed an extremely high prevalence of vitamin D deficiency (90.9%)

In a Dutch study carried out by Wielders JP et al (2006), severe vitamin D deficiency was found in 54% of newborn infants of non-European origin compared with 6% of Dutch / West European newborn infants. This study did not report data on pigmentation or

clothing habits and their possible associations with vitamin D deficiency<sup>[14]</sup>.

We found that infants those born in winter season (100%) had more deficiency of 25OHD as compare to those born in summer season (85%). Study done by S H Dijkstral et al (2007), Rotterdam, Netherlands, Vandana Jain et al (2011) from New Delhi, India suggest there is no seasonal variation in deficiency of 25 OH Vit D3 in newborns .

In present study mothers from upper socioeconomic class (APL card holder) had more deficiency (92%) of 25OHD in their infants as compare to lower socioeconomic class (BPL card holder) (77%).

Study done in Pakistan by Atiq M, Suria A, et al (1998) shows that Significantly higher levels of vitamin D were found in infants of lower socioeconomic class and in those living in mud houses. A high prevalence of vitamin D deficiency was found in breastfed infants and nursing mothers, predominantly among those belonging to the upper socioeconomic class. Infants of the lower socioeconomic class had comparatively higher levels of serum 25OHD. Similar observations were made by Marwaha et al.<sup>[15]</sup>

A Cochrane review in 2016 concluded that limited data is available regarding maternal Vitamin D requirements during pregnancy and lactation, despite the fact that maternal Vitamin Deficiency has been documented in a number of studies. In view of positive correlation between vitamin D status of the mothers exclusively breastfed infants, it has been suggested that improving the Vitamin D levels of the mothers may improve the Vitamin D levels of the infants.<sup>[16]</sup>

### Conclusion

From the results of this study, we have concluded that though breast feeding is best feeding, but as 77%

infants on exclusive breast feeding are deficient in serum Vitamin D3 levels. Maternal Parameters which have the effect on vitamin D levels in infants were wearing burqa, dark complexion, sun exposure, economic status and religion found to be significantly associated with low level of Sr. 25 OH Vit D3 in infants. Hence it is recommended to supplementing Vitamin D3 for the antenatal and lactating mothers and their infants irrespective of gestational age, Weight along with breast feeding, also Maternal awareness needs to be created regarding the need for sunlight exposure for preventing Vitamin D3 deficiency in infants.

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