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A STUDY BETWEEN RELATIONSHIP OF VITAMIN D LEVEL OF MOTHER AND ANTHROPOMETRIC INDICES OF TERM NEONATES

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ABSTRACT

Background: Vitamin D deficiency in women is unexpected in south Asian countries including India blessed with abundant sunshine. In central part of India, there are few studies about the demographic characteristics of women with vitamin D deficiency and its correlation with birth weight and birth length. The aim of this study was to evaluate demographic characteristics of pregnant women in relation to vitamin D deficiency and relate with neonates birth weight and birth length. **Methods:** A cross-sectional descriptive analytical study of 100 pregnant women was carried out in government and government aided hospitals in Indore district in the state of Madhya Pradesh. An exclusion criteria was applied. A questionnaire was designed and demographic data were recorded. Participants socioeconomic status, level of vitamin D deficiency and body mass index as measure of health were classified as per guidelines. 25-hydroxy vitamin D3 was assessed in pregnant women and in umbilical cord blood of new born. **Results:** Maternal vitamin D severe deficiency was noted in 9%, deficiency in 59%, insufficiency in 21% and sufficiency in 11% of 100 participants. Age of the participants varied from 18 years to 39 years with average of 28± 7.14 years. Birth weight of 100 new born was in the range 1685 to 3300 gm with average of 2335±41.8 gm. Birth length of the newborn was in the range 34.2 to 54.9 cm with average of 44.3±4.78 cm. The newborn with vitamin D deficiency level <20 ng/ml were underweight Average weight of newborn with insufficient vitamin D level was 2566.6±86.4. **Conclusions:** Though maternal vitamin D level is significantly associated with socioeconomic status of participants, vitamin D deficiency was found even in women belonging to upper and upper middle class. Vitamin D deficiency is significantly related with birth weight and birth length. Similar results were obtained in a study of pregnant women in south India,[9] and in Iran.[16]

KEYWORDS: Pregnancy, new born, vitamin D, birth weight, length, socioeconomic status.

INTRODUCTION

A pregnant woman needs vitamin D to support her own health and to support her fetus. Therefore it is important to achieve and maintain adequate vitamin D in pregnant women. Vitamin D deficiency in pregnant women is a significant problem all over the world.[1,2] One of the important reasons for vitamin D deficiency in women is lack of sunlight exposure. It is particularly significant for women in the tropical countries.[3,4] such as India, Pakistan, Bangladesh, Iran etc. even though these countries are blessed with abundant sunshine throughout the year. Vitamin D deficiency is unexpected in these tropical countries. This dilemma could be partly explained by the many prevalent social and cultural practices that preclude adequate exposure of women to sunshine. Revealing clothing is frowned on in traditional Hindu and Muslim households, both rural and urban. Newly married females are expected to cover themselves even more and are discouraged from outdoor activity. Increasing urbanization that results in poor outdoor activity and greater pollution, coupled with skin pigment, may further compound this problem.[2,5] Women in Iran have a veil that covers the head and chest due to culture and traditional reasons and pregnant women are discouraged from outdoor activity, which causes serious problem in vitamin D levels for Iranian pregnant women.[4]

Placental and maternal decidual cells express the enzyme to synthesize the active 1, 25-dihydroxyvitamin D_3 and have vitamin D receptors allowing for numerous potential roles of vitamin D in pregnancy including fetal growth restriction.[6] However there is mixed evidence in observational studies worldwide connecting vitamin D to fetal growth. Methodologies and quality of studies widely differ, with late pregnancy vitamin D assessment and small sample size seeming to contribute to null findings.[6] Most vitamin D studies have assessed birth weight, a nonspecific summary measure of physiological fetal growth, yet some have also investigated small for gestational age (SGA), a marker of pathological growth.[6]

Food intake provides 25-hydroxyvitamin D; an important form of vitamin D. Sources of vitamin D exist

in foods such as egg yolk, fatty fish, fish oil, fortified foods and vitamin supplements but diet provides only part of body needs. Exposure to sun light (ultraviolet B (UVB) radiation) in the range of 280–320 nm is another major source of vitamin D. Inadequate radiation or lack of UVB and in turn reduced dermal synthesis is considered as one of the main determinants of vitamin D deficiency. Milk is the primary source of calcium in India. Deficient calcium intake has been shown to be the cause in a large proportion of childhood rickets in India. Problem is likely to worsen during pregnancy for women having vitamin D deficiency and poor dietary calcium intake because of the active transplacental transport of calcium to the developing fetus. Hypovitaminosis D during pregnancy has important consequences for the newborn, including fetal hypovitaminosis D, neonatal rickets and tetany, and infantile rickets.[7,8]

Aim of this study is to determine the vitamin D deficiency in pregnant women and newborns, investigate dependence of this deficiency on demographic predictive factors and evaluate effect of maternal vitamin D deficiency on birth weight and length.

MATERIALS AND METHODS

A cross-sectional descriptive analytical study was carried out in government hospitals and government aided hospitals in Indore district in the state of Madhya Pradesh. These hospitals cater to medical needs of urban as well as rural population in central India. The study was carried out during the year 2017. The target population included term normal birth weight (>2500 gr), term neonates with low birth weight (< 2500 gr) and their mothers. Sample size consisted of 100 pregnant women. The exclusion criteria included mothers with twin or multiple pregnancies, congenital anomalies in the newborn and liver and kidney disorder subjects etc.

A questionnaire was designed by the author by referring to recent studies on the subject in other parts of India and in other tropical countries.[2,9,10] Informed consent was obtained from the pregnant women and the nature of the study was explained to them. Data were recorded on birth weight and length, type of delivery, mother's age, education, occupation and monthly per capita family income, parity, and clinical vitamin D deficiency symptoms. Socioeconomic status was categorized according to the total score of education, occupation and monthly per capita family income.[11]

Immediately after birth, 5 ml of mother's blood was collected, labeled and sent to laboratory to assay serum 25- (OH) vit D level by 25- Hydroxy Vitamin D Enzyme immunoassay method. Level of vitamin D deficiency were classified as per guidelines of Institute of Medicine (IOM),[12] Vitamin D deficiency is based on the serum level of 25(OH)D3(Table 1).

Table 1: Classification of vitamin D deficiency.[12]

Level of Deficiency/ Sufficiency	Serum level of 25(OH)D3
severe deficiency	<10 ng/ml
deficiency	<20 ng/ml
insufficiency	20- 30 ng/ml
sufficiency	>30 ng/ml

Participants are classified as underweight, healthy, overweight, obese according to body mass index values being, 19 Kg/m², 19-24 Kg/m²,25-29 kg/m^2, 29 kg/m^2 respectively.

RESULTS

Sample size consisted of 100 pregnant women. These were grouped into four classes according to level of vitamin D deficiency as per criteria stated in table 1. Vitamin D severe deficiency was noted in 9%, deficiency in 59%, insufficiency in 21% and sufficiency in 11% of 100 participants. Figure 1 shows percentage distribution of participants and new born in the four vitamin D level classes.

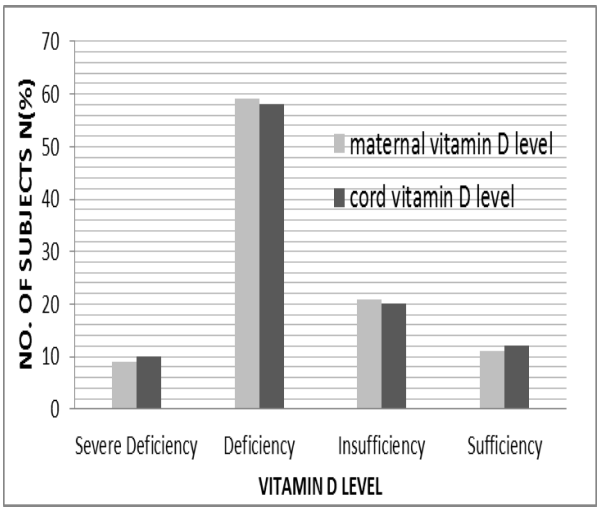

Figure 1: Distribution of serum levels of 25 (OH) D3 in the mothers and new born (N=100).

Demographic characteristics of the four classes of participants are shown in table 2 below.

Table 2: Association of socio-demographic and obstetrical characteristics with maternal vitamin D level.

Characteristic	Maternal Vitamin D Level				
	Severe Deficiency (N=9)	Deficiency (N=59)	Insufficient (N=21)	Sufficient (N=11)	Total (N=100)
Maternal Age(Years)					
18-22	5	24	0	1	30
23-27	1	8	12	5	26
28-32	0	4	3	3	10
33-37	0	17	4	1	22
38-39	3	6	2	1	12
Socioeconomic Class					
Upper Class(UC)	0	1	1	0	2
Upper middle(UM)	0	8	1	8	17
Lower middle(LM)	1	12	5	2	20
Upper lower(UL)	0	9	12	1	22
Lower(L)	8	29	2	0	39
Body mass index (Kg/m²)					
Underweight(<19)(U)	9	26	0	0	35
Healthy(19-24)(H)	0	8	16	7	31
Over weight(25-29) (OW)	0	13	0	2	15
Obese (>29)(OBE)	0	12	5	2	19
Parity					
Nulliparous(P)	5	30	9	3	49
Multiparous(M)	4	29	12	8	51
Type of Delivery					
Normal(N)	4	33	9	3	49
Cesarean(L)	5	26	12	8	51

Age of the participants varied from 18 years to 39 years with average of 28± 7.14 years. 56% of the women were between 18 and 27 years age and 34% were between 33 to 39 years age. Though maternal vitamin D level is significantly associated with socioeconomic status of participants, vitamin D deficiency was found even in women belonging to upper and upper middle class. 39% women belonged to lower socioeconomic class and level of vitamin D was not sufficient in these women. 8 out of the 19 women belonging to upper and upper middle socioeconomic class had vitamin deficiency. It implies that the government hospitals in Indore district mainly cater to need of socioeconomically weaker section of society. Maternal vitamin D level is insignificantly associated with parity and type of delivery.

Body mass index,[9] of participant was defined as weight of participant in kilograms divided by height of participant in meters squared. 35% of the participants were underweight. None of the participant was underweight in sufficient vitamin D level class and in the insufficient vitamin D level class.

Table 3 shows the association of new born birth weight and birth length with cord vitamin D level. Birth weight of 100 new born was in the range 1685 to 3300 gm with average of 2335±41.8 gm. Birth length of the newborn was in the range 34.2 to 54.9 cm with average of 44.3±4.78 cm. The newborn with severe vitamin D deficiency level were underweight with average of 2000±201.7gm. The new born with vitamin D deficiency level were also underweight with average of 2170.7±131.6 gm. Average weight of newborn with insufficient vitamin D level was 2566.6±86.4.

Table 3: New born characteristics association with cord vitamin D level.

Characteristic	Cord Vitamin D Level				
	Severe Deficiency (N=10)	Deficiency (N=58)	Insufficient (N=20)	Sufficient (N=12)	Total (N=100)
Birth Weight (gm)	2000±201.7	2170.7±131.6	2566.6±86.4	2978.1±261.1	2335 ± 341.8
Birth Length (cm)	36.9±4.3	43.2±3.08	47.06±2.84	50.5±2.7	44.3 ± 4.78

DISCUSSION

Though maternal vitamin D level was found to be significantly associated with socioeconomic status of participants, vitamin D deficiency was also found even in women belonging to upper and upper middle class in central part of India. In a study in Iran,[10] no relationship was found between mother's education and the level of vitamin D. South Asian countries (India, Pakistan, Bangladesh, Iran etc.) have abundant sunshine throughout the year but lifestyle of women is such that

exposure to direct sunlight is very low thus causing deficiency of vitamin D. Revealing clothing is prohibited in traditional Hindu and Muslim households, both rural and urban.

Present study shows high level of correlation between cord blood vitamin D levels and maternal vitamin D levels. In a similar study in south India,[9] a strong correlation between vitamin D levels in maternal and cord blood has been shown. This establishes that the fetus is solely dependent on its mother for the supply of this vitamin.

The study shows a high prevalence of vitamin D deficiency in the pregnant women in the central part of India. Vitamin D deficiency in participants increased the risk of low birth weight neonate and it also had an effect on the length of the baby. Birth weight and birth length are found to be significantly related with cord vitamin D level. Similar results were obtained in a study of pregnant women in south India.[9] Nasrin et al,[10] also found a significant correlation between low birth weight and maternal vitamin D deficiency in pregnant women in Iran.

Few studies have been conducted to detect vitamin D status in pregnant women in south Asian countries. In Iran, vitamin D deficiency was found to have widespread incidence, especially in rural women (61.1%) in comparison to the urban ones (46.2%).[13] Vitamin D deficiency is also reported to be very common in Pakistani mothers and infants.[14] A study among Chinese population demonstrated that newborns of mothers with severe vitamin D deficiency had lower birth length and weight.[15]

Daniel E. Roth et al,[16] carried out a detailed study on a large sample of 1,300 pregnant women in Bangladesh. Purpose was to evaluate the dose dependent effects of prenatal vitamin D supplementation, with and without postpartum supplementation, on infant growth and other maternal, newborn and infant outcomes in Dhaka, Bangladesh. The study did not support routine vitamin D supplementation in pregnancy or lactation to improve birth outcomes or infant growth, even in communities with endemic vitamin D deficiency and fetal infant growth restriction.

CONCLUSION

It is concluded that vitamin D deficiency is prevalent in pregnant women and their newborns in central part of India. Vitamin D deficiency had an effect on the birth weight and birth length. It is important to note that vitamin D deficiency could occur in pregnant women irrespective of their socio economic class.

Although this study did not evaluate the effects of maternal nutrition, supplemental intake and the amount of sunlight exposure on the vitamin D status, these factors need to be considered in an integrated study of various factors. More research is needed to establish whether modifying maternal nutrition behavior and vitamin D level could be beneficial on prevention of low birth weight.

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