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Prospective Comparative Study of Prevalence of Vitamin D3 Deficiency in First Trimester Pregnancy in Urban and Rural Areas

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Abstract: ***Introduction*: Vitamin D3 deficiency during pregnancy may have a negative effect on both mother and child. The aim of the present study is to do a comparative study of prevalence of vitamin D3 deficiency during first trimester of pregnancy in Indian women in urban and rural areas and to decide if vitamin D3 supplementation is needed in pregnancy. *Materials and methods*: Prospective comparative study of prevalence of vitamin D3 deficiency in first trimester pregnancy in urban and rural areas was carried out at B. J medical college from January 2016 to January 2017. Blood samples of urban women from Ahmedabad civil hospital were collected routinely for screening for serum Vitamin D3 during first trimester of pregnancy and blood samples of rural women were collected from Kavitha village of Ahmedabad district. The serum concentrations of vitamin D3 were analysed by the High Performance Liquid Chromatography. *Results*: In 84% of the study population (N=50), vitamin D3 concentrations were below 30ng/ml, which is attributed to an insufficient status. 6% of population had vitamin D3 concentrations below 10ng/ml. Among total population, the mean vitamin D3 level was 21.21 ng/ml. In 100% of the urban study population (N=25), vitamin D3 concentrations were below 30ng/ml. 8% of urban study population vitamin D3 concentrations were below 10ng/ml which is attributed to a deficient status. Among urban population, the mean vitamin D3 level was 18.48ng/ml.In 68 % of the rural population (N=25), vitamin D3 concentrations were below 30ng/ml and 8% of rural study population had vitamin D3 concentrations below 10ng/ml. Among total rural population, the mean vitamin D3 level was 23ng /ml. This shows that in rural population vitamin D3 level was higher as compared to urban population. *Conclusion*: A high prevalence of vitamin D deficiency was observed in early pregnancy in urban population which was related to education, occupation, diet, dressing habit, parity, use of multi-vitamins and season at sampling. However the study is limited considering only prevalence of vitamin D deficiency and a longer and detailed follow up is required to assess the effect on maternal and neonatal outcome. *Clinical Relevance*: This shows significant deficiency of vitamin D3 in pregnancy, especially in urban women. The women should receive nutritional and general pregnancy counselling and more attention should be given for vitamin D supplementation.***

Keywords: Vitamin D3; pregnancy outcome; vitamin D3 deficiency, first trimester pregnancy, Rural, Urban

1. Introduction

Vitamin D is a secosteroid and the most significant source is direct exposure of the skin to sunlight. It can also be obtained from dietary sources, nutritional supplementation and food fortification.[1]Vitamin D deficiency (VDD) is identified as a public health problem in many countries, and pregnant women have been identified as a high-risk group, among whom the prevalence of VDD ranges between 20 and 40%.[2] Vitamin D3 deficiency during pregnancy may have a negative impact on both mother and child.[3] In the first trimester, the foetus accumulates 2-3mg/day of calcium in the skeleton, which doubles in the last trimester.[4]The aim of the present study is to do comparative study of prevalence of vitamin D3 concentrations during first trimester of pregnancy in Indian women in urban and rural areas and to decide if vitamin D3 supplementation is needed in pregnancy. As there is less exposure of sunlight in community living in urban areas as compared to community living in rural areas because of life style, crowded residence and type of housing available.

Objective

To assess serum levels of 25-hydroxyvitamin D $[25(OH)D]_3$ in the first trimester in rural and urban pregnant females, determine the prevalence of deficiency in both population and assess factors affecting serum vitamin D_3 levels.

2. Materials and Methods

A total of 50 pregnant females were studied from January 2016 to January 2017 which consisted of 25 from urban area who visited Ahmedabad civil hospital OBGY department OPD during first trimester of pregnancy (9th – 12th gestational weeks) and 25 from rural area of Kavitha village having 30,000 population. Data on season and gestational age at sampling, maternal age, parity, numbers of earlier gestations and spontaneous abortions, maternal BMI, and smoking was obtained from case paper of women coming to hospital.This study was approved by the Ethics Committee of our hospital. All participants were informed about the purpose of the study and requested to participate after giving written consent. They were asked to complete a questionnaire that included the characteristics of their pregnancy and information about the factors associated with vitamin D status. Non-fasting blood samples were taken and analysed for $25(OH)D_3$ levels. Only singletons pregnancywho had no GDM or history of diabetes mellitus and blood pressure <140/90 mmHg or no preeclampsia were included. Patients smaller for gestational ages (<5th percentile), smokers or having any systemic disease or those taking medications affecting vitamin D medications were

excluded. Data collected consisted of age, parity, BMI, type of diet, education, occupation, gestation age at serum collection, mean BP, blood sugar level, dressing habit and history of multivitamin intake. The serum concentrations of vitamin D3 were analysed by the High Performance Liquid Chromatography using coulometric electrode array detector (HPLC-CEAD) method in the biochemistry laboratory from civil hospital, Ahmedabad. Microsoft Excel version 13.0 is used to perform the statistical analysis.Although there is no fixed criteria regarding the optimal 25(OH)D level, vitamin D levels were categorized into groups as serum 25(OH)D levels <10 ng/mL, between 10–30 ng/mL and 30-100 ng/mL, indicating deficient, insufficient and sufficient vitamin D level respectively[6]. Data was represented as mean ± standard deviation (SD) and as percentages for categorical variables and tabulated comparing urban and rural groups.

3. Risk factors for Vitamin D deficiency

The main source of Vitamin D for children and adults is sunlight, so the main cause of VDD is the decrease of its production by body. Any factor that affects the transmission of UVB radiation or interferes with its skin penetration will affect the production of vitamin D.[5]. Among these risk factors are:Use of sunscreen with a protection factor of 30 reduces the synthesis of Vitamin D in the skin, above 95%. Individuals with darker skin have natural sun protection, as melanin absorbs UVB radiation, and thus they need 3-5 times longer sun exposure to synthesize the same amount of Vitamin D than individuals with light skin. Skin aging as well as age decrease the capacity of the skin to produce Vitamin D due to lower availability of 7-dehydrocholesterol. The second cause is the reduced intake of Vitamin D, as few foods contain high quantities of it (blue fish, egg yolks). The intake of the vitamin can be increased with fortified products such as dairy products, although the amount of Vitamin D they provide may be insufficient for an adequate state of ViD.[7] In severe liver failure, chronic granulomatous disease, certain lymphomas and primary hypoparathyroidism, patients have increased metabolism of 25(OH)D into 1.25 (OH)2D, and thus a high risk of VDD.[7]

4. Results and Discussion

Table 1: Characteristics of the Study Population

Age	23.5±4years
Parity n,%	
-nulligravida	24(48%)
-multigravida	26(52%)
Body mass index	22.5±4
Diet n.%	
-non vegetarian	14(28%)
-vegetarian	36(72%)
Education n,%	
-no formal education	37(74%)
-finished high school	10(20%)
-post graduation	3(6%)
Occupation n,%	
-unemployed	34(68%)
-unskilled work	11(22%)
-skilled work	05(10%)
Gestational age at serum collection	10.5±2 weeks
Season – winter	50(100%)
Mean systolic BP	110mm hg
Mean diastolic BP	70 mm hg
Random blood sugar level	78mg/dl
Maternal multivitamin use n,%	
-yes	31(62%)
-no	19(38%)
Consumption of dairy products n,%	
-sufficient	19(38%)
-insufficient	31(62%)
Dressing habit n,%	
-covered	33(66%)
-uncovered	17(34%)

Table 2: Association of Serum Vitamin D3 Levels and Characteristics Of Study Population:

	<10ng/ml	10-30ng/ml	>30ng/ml
Age	23.5±4years	23.5±4years	23.5±4years
Parity Urban area:			
-primigravida	0	10(40%)	0
-multigravida	1(4%)	14(56%)	0
Rural area:			
-primigravida	0	7(32%)	7(32%)
- multigravida	1(4%)	9(36%)	1(4%)
Body mass index	22.5±4	22.5±4	22.5±4
Diet Urban area:			
-non vegetarian	0	5(20%)	0
-vegetarian	2(8%)	18(72%)	0
Rural area:			
-non vegetarian	0	3(12%)	6(24%)
-vegetarian	1(4%)	13(42%)	2(8%)
Education			
Urban area:			
-non formal	0	1(4%)	0
-high school	1(4%)	3(12%)	0
-post graduation	1(4%)	19(76%)	0
Rural area:			
-non formal	0	13(42%)	5(20%)
-high school	0	3(12%)	3(12%)
-post graduation	1(4%)	0	0
Occupation Urban area:			
-housewife	2(8%)	18(72%)	0
-unskilled work	0	0	0
-skilled work	0	5(20%)	0
Rural area:			
-housewife	1(4%)	13(42%)	0
-unskilled work	0	3(12%)	8(32%)
-skilled work	0	0	0
Mean systolic BP	110 mmHg	110 mmHg	110 mmHg
Mean diastolic BP	70 mmHg	70 mmHg	70 mmHg
Blood sugar level	78mg/dl	78mg/dl	78mg/dl
Multivitamin intake			
Urban area:			
-yes	0	15(60%)	0
-no	2(8%)	8(32%)	0
Rural area:			
-yes	0	10(40%)	6(24%)
-no	1(4%)	6(24%)	2(8%)
Dairy product intake			
Urban area:			
-sufficient	0	5(20%)	0
-insufficient	1(4%)	19(76%)	0
Rural area:			

-sufficient -insufficient	0 1(4%)	6(24%) 10(40%)	8(32%) 0
Dressing habits Urban area: -covered -uncovered Rural area: -covered -uncovered	 2(8%) 0 1(4%) 0	 13(42%) 10(40%) 16(64%) 0	 0 0 1(8%) 7(32%)

Table 1 shows study population characteristics and its component. Vitamin D3 concentrations sampled during first trimester of pregnancy. Most samples were obtained at 5-12thgestational week mostly during winter. In 84% of the study population (N=50), vitamin D3 concentrations were below 30ng/ml, which is attributed to an insufficient status. The population 6% had vitamin D3 concentrations below 10ng/ml, which is attributed to a deficient status and only 16 % had values greater than 30ng/ml, which represents sufficiency. Among total population, the mean vitamin D3 level was 21.21 ng/ml. Vitamin D status from urban and rural population was compared. In 100% of the urban study population (N=25), vitamin D3 concentrations were below 30ng/ml, which is attributed to an insufficient status. The population 8% had vitamin D3 concentrations below 10ng/ml, which is attributed to a deficient status. Among total urban population, the mean vitamin D3 level was 18.48ng/ml.

In 68 % of rural study population (N=25), vitamin D3 concentrations were below 30ng/ml, which is attributed to an insufficient status. The population 4% had vitamin D3 concentrations below 10ng/ml, which is attributed to a deficient status and 32 % had values greater than 30ng/ml, which represents sufficiency. Among total rural population, the mean vitamin D3 level was 23ng/ml.This shows that in rural population had higher vitamin D3 level as compared to urban population.

We compared relation of vitamin D level and parity in urban and rural areas. It shows more deficiency in multigravida as compared to primigravida and more in urban area as compared to rural area. Relation of diet (Non vegetarian vs. vegetarian) and vitamin D3 level was compared. It shows more insufficiency in vegetarian as compared to non-vegetarian and more in urban area as compared to rural area. In relation to occupation, there is more insufficiency in housewife and skilled workers as compared to unskilled workers and more in urban area as compared to rural area.

In relation to education, there is inverse relationship between vitamin D3 level and education most probably due to more indoor work in educated person. In relation to dairy product intake, there is more insufficiency of vitamin D3 level people who take insufficient dairy product intake and more in urban area as compared to rural area. In relation to dressing habits, insufficiency of vitamin D3 is more in people who wear covered clothes and more in urban area as compared to rural area. We also compared the groups and found no significant differences between the groups concerning maternal age, BMI values, blood sugar levels, systolic and diastolic blood pressures at the baseline study visit and gestational age at serum collection. First trimester vitamin D3 levels were not associated with the gestational age at birth in women who delivered after term pregnancy, with the mode of delivery, foetal sex, birth weight, or duration of hospital stay after birth (data not shown).

This study showed that most of the Indian pregnant women with uncomplicated pregnancy were vitamin D3 deficient or insufficient in the first trimester, with only a few (16%) having sufficient (>30 ng/ml) vitamin D concentrations. The factors associated with maternal vitamin D3 concentrations were sampling season, education, diet, dressing habits and maternal age, parity, residentialarea, occupation.

The Women should receive nutritional and general pregnancy counselling, we should pay more attention to vitamin D supplementation. All the factors should be taken into account by advising and encouraging, according to the individual food tolerance, to increase the intake of natural occurring vitamin D rich foods (fatty fish, mushrooms, eggs) or vitamin D fortified foods, regular supplementation and sun bathing whenever is possible.

5. Conclusion and Implications

We conclude that higher prevalence of vitamin D deficiency observed in urban population was related to dressing habit, occupation, diet especially dairy products intake and more indoor work. More large multicentre clinical trials are necessary to establish the vitamin D clinical involvement in human health and disease. The present study adds to current scientific information regarding prevalence of vitamin D deficiency in apparently healthy pregnant women. However the study is limited considering only prevalence of vitamin D deficiency and a longer and detailed follow up is required to assess the effect on maternal and neonatal outcome.

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