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Prevalence of Vitamin D deficiency among Reproductive age group and Co-relation with pregnancy-related complications-A Hospital Based Study

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Abstract

Introduction: Vitamin D plays a vital role in healthy reproductive life. In addition to its importance for the regulation of calcium and phosphorus homeostasis also regulates the expression of a large number of genes in reproductive tissues implicating a role for Vitamin D in female reproduction. A large number of women of reproductive age are identified as Vitamin D deficient and the prevalence is significant. Evidence shows higher rates of pre-eclampsia, pre-term birth, gestational diabetes in women with low Vitamin D levels that can easily be prevented by early diagnosis and administration of Vitamin D supplementation.

Aim of the study: The aim of the study was to investigate the prevalence of Vitamin D deficiency among women of the reproductive age group and Co-relation with pregnancy-related complications.

Methods: It was a retrospective study. Serum 25 hydroxy vitamin D concentration was determined by Chemiluminescent Micro-Particle Immunoassay for 900 reproductive age group {20-40years} attended the department of OBGYN of United hospital during the period of Jan' 17 to Dec '18 for different complaints. Among them 360 of them were pregnant.

Result: Of nine hundred study population, four seventy-one (471, 52.33%) was in the age group ranging from twenty to thirty. The rest of them (429, 47.66%) were more than thirty age of years ranging from thirty-one to forty. The mean age of women was thirty (30±2×SD). Five forty-nine (549, 61%) was non-pregnant and the

rest of three fifty-one was pregnant (351,49%). The two eighty-one pregnant (281, 80.06%) women had VDD (<20ng/mL) which constitutes four-fifths of the total number of pregnant women (n=351). Among five forty-nine non-pregnant study populations (n=549), three eighty (380, 69.22%) had significant Vitamin D deficiency. Two-fifty of pregnant women developed obstetric complications such as Gestation Diabetes Mellitus (115, 46%), Pregnancy Induced Hypertension (53, 21.20%), Abortion (41, 16.04%) and Both Gestation Diabetes Mellitus and Pregnancy Induced Hypertension (41, 16.04%). Statistical significance was noted with complications like Gestational Diabetes Mellitus (GDM), Pregnancy Induced Hypertension (PIH), Abortion and both GDM and PIH with a p-value of <0.05% with respect to the VDD.

Conclusion: This study observed a significant prevalence of Vitamin D deficiency in the reproductive age group population. In concordance with other studies, we found a high association of Vitamin D deficiency with pregnancy-related complications. It is clear that more routine screening of Vitamin D levels is needed and supplementation accordingly may prevent some preventable complications.

Keywords: Vitamin D deficiency, Obstetric Complications, Bangladeshi Women of Reproductive Age group, Pregnancy.

Introduction

Vitamin D deficiency is acknowledged as a crucial public health problem and global epidemic in women of reproductive age in developing countries(1). Vitamin D helps to improve fertility and maternal health. Thus this deficiency should be corrected before pregnancy(2). Worldwide different reports reflect that higher low circulating serum 25 (OH)D concentrations are linked to inadequate sunlight exposure and insufficient dietary Vitamin D in the women of childbearing age (3)(4) (5) and during pregnancy in many countries. (6). Vitamin D is a micronutrient as well as a prohormone . This prohormone has several roles in the body functions that have a considerable impact on bone health and serum calcium and phosphate levels. Likewise, it may help cell proliferation, differentiation, apoptosis and immune function. Vitamin D is linked with various significant functions in pregnancy in conjunction with glucose homeostasis, placental function, inflammatory response and infection control (7).Extensive epidemiological studies reveal the high frequency of Vitamin D in gravid and lactating mother. (8) (9) specially second and third trimester of pregnancy when physiologically higher 1,25-dihydroxy Vitamin D level is seen. But due to enhance metabolism, increase calcium absorption and fetal requirement vitamin D level remain deficient. Different studies have shown that pregnant women with Vitamin D deficiency have a higher risk of unfavorable pregnancy outcomes such as preeclampsia, gestational diabetes mellitus and Intra-Uterine Growth Retardation (IUGR) (10)(11). Pregnancy might increase the demand for vitamin D. Thus Vitamin D is an immanent agent in the body. As Vitamin D deficiency in pregnancy has an adverse outcome on maternal and fetal health, it has indicative relationships amid maternal and neonatal health (12). The purpose of the study is to evaluate the prevalence of VDD among the women of the reproductive age group and Co-relation with pregnancy-related complications which is a hospital-based study.

Material & **Methods**

This was a retrospective observational study. Total 900 females of reproductive age group ranging from 20 to 40 years attending the outpatient and inpatient department

of Obstetrics and Gynecology of United hospital Dhaka were selected consecutively following some exclusion criteria like women more than 40 years and women with vitamin D supplementation. Study period was Jan 2017 to Dec 2018 .

Data were collected by direct interview using a semi structured questionnaire and laboratory investigations were collected from central storage database and patient record files. The socio-demographic information, reproductive health characteristics, obstetrics complications, vitamin D level of study patients were recorded. Serum 25 hydroxy vitamin D concentration was determined by Chemiluminescent Microparticle Immunoassay in the United Hospital lab. Verbal consent was taken before recruiting the study population. Ethical clearance was taken from hospital authority. The information is kept confidential only be used for the study purpose.

The study coordinators performed random checks to verify data collection processes. Completed data forms were reviewed, edited and processed for computer data entry. Frequencies, percentages, cross-tabulations were used for descriptive analysis. χ 2 test was used to analyze statistical significance. The data analysis was performed using Statistical Package for the Social Sciences (SPSS) Version 25.0. The significance level of 0.05 was considered for all tests.

Results

Total 900 patients were included in this study shows that more than half of the study population (471, 52.33%) was in the age group ranging from twenty to thirty. The rest of them (429, 47.66%) were more than thirty age of years ranging from thirty-one to forty. The mean age of women was thirty (30±2×SD)(Table 1) . Women had a minimum of zero and a maximum of three children. Most of the study population (75%) was null to primiparous women. Around three-fifths of the study population (549, 61%) was non-pregnant and the rest of two-fifths was pregnant (351,49%).The majority (845, 93.9%) had no history of pregnancy loss. Perhaps, a small number of women (55,6.1%) had a history of pregnancy loss. (Table-1) The two eighty-one pregnant (281, 80.06%) women had VDD (<20ng/mL) which constitutes four-fifths of the total number of pregnant women (n=351). Furthermore, only forty-nine (49,13.96%) child-bearing women were Vitamin-D insufficient (21-<30 ng/mL) and the remaining twenty-one women (21,5.98%) had optimal Vitamin-D levels (≥ 30 ng/mL). Among five forty-nine non-pregnant study populations (n=549), three eighty (380, 69.22%) had significant Vitamin D deficiency, eighty-six (86, 15.66%) had normal Vitamin-D levels and eighty-three (83, 15.118%) were at the condition of Vitamin-D insufficiency (Table 3). Two-fifty of pregnant women developed obstetric complications which included in Table 5: Gestation Diabetes Mellitus (115, 46%), Pregnancy Induced Hypertension (53, 21.20%), Abortion (41, 16.04%) and both Gestation Diabetes Mellitus and Pregnancy Induced Hypertension (41, 16.04%). Statistical significance was noted with complications like Gestational Diabetes Mellitus (GDM), Pregnancy Induced Hypertension (PIH), Abortion and both GDM and PIH with a p-value of <0.05% with respect to the VDD (Table-5).

Discussion

Vitamin D deficiency is common globally with higher prevalence in women. 80% Asian women are vitamin D deficient. A total of nine hundred women of the reproductive age group were included in this study, with the mean age was 30±2SD and mean serum 25-OHD

Level of 18.41±SD. A similar study was conducted in Tehran in 2016 where Emdadi et al. reported their study population had mean age of 31.17±SD and mean serum 25-OHD Level of 18.41±SD. (13)

In our study, around three-fourth of the study population (675, 75%) had zero to one child. This study was conducted in the United Hospital of Dhaka City that is one of the costliest hospitals in Bangladesh. Patients who visited this hospital are predominantly are from higher socioeconomic groups, ambitious and well educated. In a recent study in Tehran, more than three-fourth of their study population (239, 79.65%) had parity ranging from zero to one which is pretty congruous to our study.

Of the included three fifty-one pregnant women, two eighty-one were vitamin D deficient (280, 80.06%). Recently, Emdadi et al. (2016) also found a high prevalence of Vitamin D deficiency among pregnant women (83 out of 97, 85.57%).(13)

The association of Vitamin D insufficiency in pregnancy with preeclampsia and hypertension is remained controversial. There are several possible mechanisms reported. Low circulating levels of insulin-like growth factor-1 (IGF-1) and 1,25$(OH)_2$D were associated with preeclampsia. The other hypothesis is an abnormal expression of 1α-hydroxylase (a Vitamin D – activating enzyme in preeclamptic pregnancies), revealing a latent role as a regulator of placentation for 1,25(OH)2 (15) . Vitamin D is also hypothesized as an immune modulator [16]. 1,25(OH)2D could suppress T-cell receptor-induced T-cell proliferation, change cytokine expression, and decreasing γ-interferon and interleukin-2 production, which may be related to the occurrence of preeclampsia [17]. Vitamin D also influences blood pressure regulation. The relationship between plasma renin and 1,25(OH)2D activity was opposite (18). Vitamin D also involved calcium homeostasis could regulate pregnancy-induced hypertension (19). In a multicenter case–control study which enrolled women with (n = 1013) or without (n = 1015) preeclampsia, the concentration of 25(OH)D was significantly lower in the preeclampsia (mean 29.99 ng/mL; 95% CI: 29.40–30.58 ng/mL) group compared to the comparison group (mean 33.7 ng/mL; 95% CI: 33.20–34.30 ng/mL). An increased chance of having preeclampsia among women with Vitamin D deficiency was noted after adjusting for covariates (20).

The onset of impaired glucose tolerance is associated with an increased level of both intracellular Ca^{2+} and ROS. Vitamin D is known to promote insulin secretion by increasing expression of antioxidants that reduce levels of ROS, and it maintains low Ca^{2+} levels by increasing expression of the plasma membrane Ca^{2+}-ATPase, which could extrude Ca^{2+} (21).The relationship between insufficient Vitamin D and gestational diabetes mellitus (GDM) is conflicting because not all studies support these findings. However, there is one meta-analysis of 31 studies showed that gestational diabetes was found to be associated with Vitamin D deficiency compared with the control group (odds ratio = 1.98, 95% CI: 1.23–3.23)(22].

There were two-fifty pregnant women out of nine hundred study population (250, 27.78%) who developed obstetric complications like GDM (115, 46%), PIH (53, 21.20), Abortion (41, 16.04%) and both GDM+PIH (41, 16.04%). Statistical significance was found between pregnancy and obstetric complications. There is some evidence that supports our study. Van der Pligt (2016) reviewed and found the amelioration of the Vitamin D status in maternal Health for best maternal and child

health outcomes in the region of Asia, Middle-East, Africa and Latin America is inevitable (14).

Table 1: Characteristics of Study Population (N=900)

Characteristics	No.%
Age	
20-30	471(52.33%)
31-40	429(47.66%)
Mean age 30±2×SD	
Parity	
0-1	675(75%)
2-3	225(25%)
Pregnancy	
Non-Pregnant	549 (61%)
Pregnant	351 (49%)
H/O Pregnancy Loss	
Pregnancy Loss	55 (6.10%)
No H/O Pregnancy Loss	845 (93.90%)

Table 2: Endocrine Society's classification of vitamin D status

References value of Vitamin D3- 25(OH) D	Ranges in serum (ng/ml)
Vitamin D sufficiency	≥30
Vitamin D insufficiency	20-29.99
Vitamin D deficiency	<20

Table 3: Distribution of Study Population According to Vitamin D level (n=900)

N=900	No. %	p-value
Normal Vitamin D + Non-Pregnant	86 (9.50%)	P<0.05
Normal Vitamin D + Pregnant	21(2.33%)	p<0.05
Vitamin D Insufficiency+ Non-Pregnant	83(9.22%)	p>0.05
Vitamin D Insufficiency+ Pregnant	49(5.44%)	p>0.05
Vitamin D Deficiency +Non-Pregnant	380(42.22%)	p<0.05
Vitamin D Deficiency + Pregnant	281(31.22%)	p<0.05

Table 4: Distribution of Patients According to Pregnancy Status and Vitamin D level

Vitamin D status	Pregnant (n=351,%)	p-value	Not Pregnant (n=549, %)	p-value
Vitamin D Insufficiency	49 (13.96%)	p >0.05	83 (15.118%)	p >0.05
Vitamin D Deficiency	281 (80.06%)	p <0.05	380 (69.22%)	p <0.05
Normal Vitamin D Level	21 (5.98%	p <0.05	86 (15.66%)	p <0.05

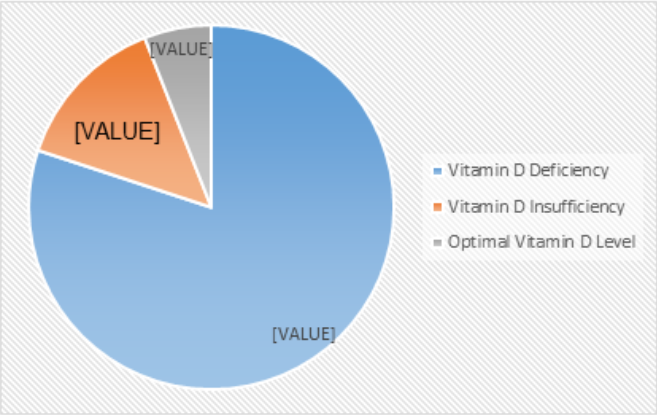

Figure 2: Pie Chart Showing Distribution of Pregnant Women Based on Vitamin D status (n=352)

Table 5: Distribution of Pregnant Women Based on Complications Development (n=250)

Obstetric Complications	No.%	*p*-value
GDM	115 (46%)	
PIH	53(21.20%)	P<.05
Abortion	41(16.04%)	
G+P	41(16.04%)	

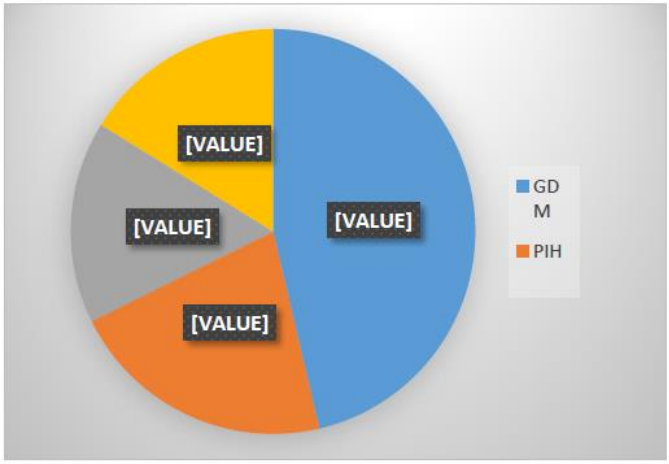

Figure 3: Pie Chart Showing Distribution of Pregnant Women Based on Obstetric Complications Development.

Conclusion

Vitamin D Deficiency is a communal problem in Bangladeshi women of childbearing age. The study found significant associations between Vitamin D deficiency and obstetric complications .Vitamin D deficiency is an important health issue and it is indigence to devise efficient policies and strategies to prevent and control Vitamin D Deficiency. Furthermore, advanced technologies should be made available nationwide to enable timely diagnosis of VDD. Research is essential to sketch a comprehensive picture of the progressing vitamin D problem and also to monitor the effects of affiliation among government, health care systems, industry and consumers aimed to improve the overall Vitamin D status among women of reproductive age group.

Ethical approval: The study was approved by the Institutional Ethics Committee

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