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ORIGINAL ARTICLE

Burden of Vitamin D Deficiency and its Related Risk Factors in Early Pregnancy

ZAHRA WASIM[1], FAIQA CHUGHTAI[2], SANA YOUSAF[3], TAHIRA RIAZ[4], TABASSUM MUZAFFAR[5], ADIBA AKHTAR[6]
[1]*Classified Gynecologist, Department of Obstetrics & Gynecology, CMH, Rawalpindi.*
[2]*Associate Professor, Department of Obstetrics & Gynecology, CMH, Rawalpindi.*
[3]*Classified Pathologist, Department of Microbiology and Histopathology, CMH, Risalpur.*
[4]*Classified Gynecologist, Department of Obstetrics & Gynecology, CMH, Rawalpindi.*
[5]*Assistant Professor, Department of Obstetrics & Gynecology, CMH, Rawalpindi.*
[6]*Associate Professor, Department of Obstetrics & Gynecology, CMH, Risalpur.*
Correspondence to: Zahra Wasim, Email: zahrawasim1973@gmail.com

ABSTRACT

Objective: To find out the burden of Vitamin D deficiency and its related risk factors in early pregnancy.
Study Design: A cross-sectional study.
Place and Duration of the Study: The Department of Obstetrics & Gynecology, The Combined Military Hospital (CMH), Risalpur, Pakistan from 1st January 2021 to 31st December 2021.
Methodology: A total of 370 healthy pregnant women visiting outpatient department in the 1st trimester for routine pregnancy examination and willing to be part of this study were included. Vitamin D deficiency was labeled as serum 25(OH)D <20 ng/mL, insufficiency as 20-32 ng/mL and sufficiency >32 ng/mL. Demographic and anthropometric characteristics along with socio-economic status, clinical profile, supplementary intake and details of life style and daily living patterns were noted in all women.
Results: In a total of 370 pregnant women, mean age was 29.92±5.5 years. Multivariate binary logistic regression analysis showing association of vitamin D insufficiency/insufficiency with daily sunlight exposure below 1 hour (p<0.001), low socioeconomic status (p=0.002), working women (p=0.025), no use of vitamin D supplementation before pregnancy (p=0.044) and no use of vitamin D in the current pregnancy (p=0.001).
Conclusion: Serum vitamin D levels of majority of the pregnant ladies in the 1st trimester were found to be either deficient or insufficient. Less daily sunlight exposure, low socioeconomic status, working women, no use of vitamin D supplementation before pregnancy or during 1st trimester were found to have significant association with vitamin D deficiency.
Keywords: 1st trimester, pregnant, sunlight exposure, vitamin D,

INTRODUCTION

Vitamin D is vital for the homeostasis and bone mineralization. Primary source of vitamin D is attained by the direct synthesis from the sunlight to the skin.[1] Dietary or supplementary intake of vitamin D is synthesized in the form of vitamin D_2 while dietary intake is estimated to fulfill about 10% of vitamin D needed as not many food types contain sufficient vitamin D which is the reason why vitamin D supplementation is considered very important.[2,3]

Researchers have calculated that over 1 billion people around the world suffer from vitamin D deficiency (VDD) or insufficiency, according to their findings.[4] When women are pregnant, the amount of 25(OH)D in their blood increases by up to double between 10 and 12 weeks of pregnancy, reaching its greatest level in the third trimester.[5] The significant increase in the 25-hydroxyvitamin D in maternity is expected to promote more biological exposure to vitamin D, particularly in the second and third trimesters, and supports the notion that vitamin D plays a critical role in the health of pregnant women..[6,7]

In Pakistan, no study has been conducted to identify risk factors of VDD in early pregnancy period so we aimed the present study to find out the burden of VDD and its related risk factors in early pregnancy. The findings of this study were thought to provide useful information about the extent of VDD in women during early pregnancy period.

METHODOLOGY

After taking consent from IRB of hospital this cross sectional study was conducted from January 2021 to December 2021 at Outpatient Department of Obstetrics and Gynecology the Combined Military Hospital (CMH), Risalpur. Sample size was estimated at prevalence of 370 of VDD being 81% among pregnant women and a 95% confidence level with a 4% margin of error.[8]

Totally 370 pregnant women visiting outpatient department in the first trimester for routine pregnancy examination and willing to be part of this study were included. All pregnant women with twin pregnancy, diabetes, hypothyroidism, hypertension, chronic liver disease or immune disorders were not enrolled. Pregnant women with history of routine calcium supplement usage or with history of anti-epileptic agents, glucocorticoids, anti-estrogen drugs or anti-retroviral drugs were also not included. All included pregnant women were ensured about the confidentiality of their data and were informed to have the right to withdraw from this study at any point.

Three ml blood samples were taken from all study participants and sent to institutional laboratory for biochemical serum 25(OH)D levels. Vitamin D deficiency was labeled as "serum 25(OH)D <20 ng/mL", "insufficiency as 20-32 ng/mL" and "sufficiency >32 ng/mL". Demographic and anthropometric characteristics along with socio-economic status, clinical profile, supplementary intake and details of life style and daily living patterns were noted in all women.

We employed SPSS version 26.0 for data analysis. Qualitative data was shown as frequencies and percentages while comparison of qualitative data was done adopting chi-square test. Quantitative data was highlighted in the form of mean and standard deviation (SD) while its comparisons were made utilizing independent sample t-test. Binary logistic regression was applied to see the effect of known risk factors on vitamin D deficiency /insufficiency. P value<0.05 was taken as significant.

RESULTS

In a total of 370 pregnant women, mean age was 29.92±5.5 years (ranging between 18 to 39 years). Mean BMI was noted to be 25.5±1.9 kg/m^2 (ranging between 20.4 to 31.0 kg/m^2). Most of the women, 209 (56.5%) belonged to rural areas of residence. There were 263 (63.8%) women who described their daily sunlight exposure below 1 hour. Educational status of 74 (20.0%) women was illiterate. Evaluation of vitamin D status revealed that vitamin D levels were sufficient in 64 (17.3%), insufficient 121 (32.7%) and deficient in 185 (50.0%). Table-1 is showing characteristics of women enrolled.

For convenient comparison regarding vitamin D status, all women were either grouped as having sufficient vitamin D level or insufficient/deficient. It was revealed that daily sunlight exposure below one hour (p<0.001), low socioeconomic grade (p<0.001), working status as working women (p=0.009), no use of vitamin D

supplementation before current pregnancy (p<0.001) and no usage of supplementation of vitamin D in the current pregnancy (p<0.001) were having significant association with vitamin D insufficiency/deficiency. Table-2 is showing comparison of study characteristics.

Table 1: Features of Gravid Women (n=370)

Features of women		Number (%)
Age (y)	<30	175 (47.3%)
	≥30	195 (52.7%)
Residence	Rural	209 (56.5%)
	Urban	161 (43.5%)
Daily sunlight exposure in hours	<1	236 (63.8%)
	≥1	134 (36.2%)
Educational Status as Illiterate		65 (17.6%)
Low Socio-economic Status		214 (57.8%)
BMI (kg/m^2)	<25	126 (34.1%)
	≥25	244 (65.9%)
Working Status	Working	72 (19.5%)
	House Wife	298 (80.5%)
Gestational Age in weeks	<10	183 (49.5%)
	≥10	187 (50.5%)
Nulliparous		126 (34.1%)
Previous history of Abortion		27 (7.3%)
Using Vitamin D Supplementation before Pregnancy		44 (11.9%)
Vitamin D Supplementation in the 1st Trimester		76 (20.5%)
Vitamin D Status	Sufficient	64 (17.3%)
	Insufficient	121 (32.7%)
	Deficient	185 (50.0%)

Table 2: Comparison of Study Characteristics with respect to Vitamin D Status (n=370)

Characteristics		Vitamin D Status		P-Value
		Sufficient (n=64)	Insufficient / Deficient (n=306)	
Age in years	<30	35 (54.7%)	140 (45.8%)	0.193
	≥30	29 (45.3%)	166 (54.2%)	
Residence	Rural	33 (51.6%)	176 (57.5%)	0.382
	Urban	31 (48.4%)	130 (42.5%)	
Daily sunlight exposure in hours	<1	20 (31.3%)	216 (70.6%)	<0.001
	≥1	44 (68.8%)	90 (29.4%)	
Educational Status as Illiterate		15 (23.4%)	50 (16.3%)	0.175
Low Socio-economic Status		21 (32.8%)	193 (63.1%)	<0.001
BMI (kg/m^2)	<25	45 (70.3%)	199 (65.0%)	0.418
	≥25	19 (29.7%)	107 (35.0%)	
Working Status	Working	20 (31.3%)	52 (17.0%)	0.009
	House Wife	44 (68.8%)	254 (83.0%)	
Gestational Age in weeks	<10	27 (42.2%)	156 (51.0%)	0.201
	≥10	37 (57.8%)	150 (49.0%)	
Nulliparous		23 (35.9%)	103 (33.7%)	0.727
Previous history of Abortion		8 (12.5%)	19 (6.2%)	0.078
Using Vitamin D Supplementation before Pregnancy		18 (28.1%)	26 (8.5%)	<0.001
Use of Vitamin D Supplementation in the Current 1st Trimester		27 (42.2%)	49 (16.0%)	<0.001

Multivariate binary logistic regression analysis showing association of vitamin D insufficiency/insufficiency with daily sunlight exposure below 1 hour (p<0.001) was significant.

Table 3: Analysis of Binary Logistic Regression Displaying Factors Linked with Vitamin D Deficiency / Insufficiency

Factors	Odds Ratio	95% Confidence Interval		P-Value
		Lower	Upper	
Daily Sunlight Exposure <1 hour	4.2	2.2	7.9	<0.001
Low Socio-economic Status	2.8	1.5	5.2	0.002
Working Women	2.2	1.1	4.4	0.025
No Use of Vitamin D Supplementation Before Pregnancy	2.4	1.0	5.4	0.044
During this Pregnancy, there will be no use of Vitamin D supplements.	3.1	1.6	6.3	0.001

DISCUSSION

In the presents study, we noted that 82.7% of the pregnancy women in early pregnancy were either having vitamin D insufficiency (32.7%) or deficiency (50.0%) which means that the burden of women are disproportionately affected by vitamin D shortage and inadequacy during early pregnancy period. A recent study from China analyzing influence of VDD in pregnant women in terms of possible increased risk of spontaneous abortion or small for gestational age (SGA) births revealed that only 1.4% women were having sufficient vitamin D levels whereas 83.3% women had VDD and 15.4% insufficiency.[9] The authors concluded that low vitamin D levels raise the risk of spontaneous abortion and SGA births in pregnant ladies.[9] The findings of the present study weighing even more weight as we analyzed women in the early pregnancy duration and if vitamin D levels of these pregnant women are lifted as per satisfactory levels, rates of spontaneous abortions and SGA births can hypothetically be reduced in these women. Researchers have designated infection and inflammation to be some of the major causes behind premature delivery and spontaneous abortion while vitamin D is known to be an important immune regulator and preventer of infections that further emphasizes the importance of desired vitamin D levels in pregnant ladies.[10] Local data has already highlighted 58.9% housewives to have VDD while as we know the need of vitamin D is increased in the body during the pregnancy so proportion of women with VDD during pregnancy is expected to be high as shown in the present study.[11]

In this study, we noted daily sunlight exposure below 1 hour (p<0.001), low socioeconomic status (p=0.002), working women (p=0.025), no usage of supplementation of vitamin D before pregnancy (p=0.044) and no use of vitamin D in the current pregnancy (p=0.001) to have significant linkage with vitamin D deficiency/insufficiency. Aji AS et al from Indonesia revealed very similar findings that 82.8% pregnant women in early pregnancy (1st trimester) had VDD while working status, nulliparity, length of outdoor activities below 1 hour daily and no usage of supplementation prior to the pregnancy were significantly associated risk factors for VDD.[12] Bardosono et al analyzing 143 healthy pregnant ladies during their 1st visit to maternal clinics showed that 90.2% pregnant women were having VDD.[13] Some other researchers have labeled childhood factors, types of occupation, lack of physical activities, lack of vitamin D intake, proportion of body fat, urban areas of residence and geographical locations to be some other important predictors of VDD.[14,15] Relatively higher levels of VDD in the 1st trimester could be because that most of the women in that duration of pregnancy are suffering from morning sickness that could limit outdoor activities while we noted only 11.9% women using vitamin D supplementation before pregnancy whereas only 20.5% were having vitamin D supplementation in the current 1st trimester. Researchers have designated proper nutritional status by dietary supplementation prior to pregnancy to prevent adverse fetal and maternal outcomes linked with nutritional deficiencies. Screening for VDD should be mandatory for all women during their 1st visits to maternal clinics during 1st trimester.[17-19] Awareness must be created about promotion of daily sunlight exposure and outdoor activities for all age groups to prevent VDD.

Our study had some limitations as well. One major limitations could be that were unable to follow these women in the later parts of their pregnancy and ultimately to note the fetal and maternal outcomes. We did not evaluate the impact of any possible intervention (lifestyle/medical) on the levels of vitamin D. We did not analyze social factors like work/home pressure. As number of pregnant women with sufficient vitamin D levels was low that could have also influenced the results during comparisons.

CONCLUSION

Serum vitamin D levels of majority of the pregnant women in the 1st trimester were found to be either deficient or insufficient. Less daily

sunlight exposure, low socioeconomic status, working women, no use of vitamin D supplementation before pregnancy or during 1st trimester were found to have significant association with VDD.

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