ORIGINAL ARTICLE

Prevalence of Vitamin D Deficiency in Pregnant women of Al Jouf region, Kingdom of Saudi Arabia

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ABSTRACT

Aim: To determine the prevalence of vit. D deficiency amongst the pregnant women in Al Jouf region (Sakaka), Kingdom of Saudi Arabia.

Methods: This is a cross-sectional study in which blood samples were collected from 50 pregnant women that visiting the Women's Maternity & Children Hospitalin Al Jouf, (Sakaka). A questionnaire was designed to collect the participants' demographic data, including age, trimester, intake of vit. D, calcium supplements, BMI, Sun exposure, daytime sun exposure, and sun exposure duration. 5ml of venous blood were collected in a yellow top gel vacutainer under aseptic sterilized conditions to measure the Vit. Dconcentration. Serum Vit. D concentration was measured by using Enzyme-linked immunosorbent assay (ELISA) through ELISA Kit manufactured by Human Diagnostics (Germany). Serum Vit. D Level below the 20ng/mL indicates deficiency.

Results: Based on the results of the study, 35 out of 50 (70%) of the pregnant women participate in this study had a vit. D deficiency (serum concentration of 25-hydroxyvitamin D less than 20ng/mL), whereas 14 (28 %) of the participants had vit. D insufficient and only one participant (2%) had sufficient vit. D level (≥ 30 ng/mL).The prevalence of vit. D deficiency werehigh inpregnant women age groups of 20-30 years and 30-40 years collectively (85.7%) in comparison to women aged <20 years, (14.3 %).

Conclusion: This study shows high prevalent of vit. D deficiency in the pregnant women in Aljouf region (Sakaka). Dietary intake and supplementation may be necessary for pregnant women and recommended during antenatal care.

Keywords: Vit. D deficiency, Pregnancy, Pregnant Women, Al Jouf Region

INTRODUCTION

Vitamin D (Vit. D)is a crucial fat-soluble secosteroid that has a significant role in maintaining good health and essential in regulating calcium metabolism[1]. Vit. D(25-(OH)-D) can be obtained exogenously from dietary sources, and the human body can also synthesize it via direct exposure of the human skin to ultraviolet B (UVB)[2]. Sunlight is by far the most essential inducer for vit. Dsynthesis in the human body. It is manufactured by the interaction of vit. Dpercussor, 7-dehydrocholesterol (7-DHC), in the human skin with ultraviolet B (UVB) radiation from the sun. Small quantities of vit. Dis also found naturally in some foods.

Additionally, it is also present in synthetic form in vit. D supplements, which are readily available in the pharmacies[3]. Vit. D presents in two forms known as vit. D2 (also called ergocalciferol) and vit. D3 (cholecalciferol).Vit. D2 is derived from different sources such as mushrooms, yolk of the egg, fatty fish, and sardines. Vit. D3 is synthesized through the photochemically conversion of 7-DHC, in the human epidermis to first pre-vit. D3 and vit.D3(cholecalciferol) and is also taken through the animal-baseddiet. Following synthesis, cholecalciferol is converted to circulating form, 25-hydroxy vit. D (25-(OH)-D), and then further converted to its active form, 1,25-dihydroxy vit. D, by the enzymatic hydroxylation reactions in the liver and kidney[2].

Deficiency of vit. D is a serious health issue and is related to the risk and severity of many other illnesses. Prevalence of vit. D deficiency in subgroups of population such as women and children, has also been reported even in places with abundant sunshine[4]. Worldwide, more than two billion people are suffering from vit. D deficiency (< 20 ng/ml). This deficiency is usually associated with several skeletal and non-skeletal manifestations such as rickets/ osteomalacia, osteoporosis, autoimmune diseases, obesity, type 2 diabetes mellitus, cardiovascular diseases, and cancers. Pregnant women are potentially at high-risk of vit. D deficiency than any other human group[5], which increases the risks of complications to the pregnant women and the growing fetus[6]. Enough evidence is already available about numerous harmful maternal and neonatal health outcomes resulting from deficiency of vit. D, including pre-eclampsia, gestational diabetes, postpartum depression, cesarean section delivery, preterm labor, and low neonate body weight[7].Luckily, vit. D concentration is changeable and influenced by multiple factors; hence it is crucial to consider the various determinants related to vit. D deficiency during pregnancy[8]. The well-known contributor to the vit. D deficiency is limited amount of sunlight exposure, daytime sun exposure, low physical activity, indoor restriction during the day, skin pigmentation, high rise buildings, and atmospheric pollution[9].

The causes of vit. D insufficiency and inadequacy during pregnancy seem to be multi-factorial, and it is not limited to factors such as amount of sunlight exposure. Nevertheless, it also includes age, ethnicity, socioeconomic status, repeated pregnancies, obesity, mal-absorption syndromes, and chronic diseases of the liver and kidney[10]. Additionally, an individual's lifestyle, like poor calcium and dietary vit. D intake, sedentary behavior, smoking, and metabolic disturbances like high triglyceride levels, has also reported to affect vit. D status[11].

Recently, there has been increased certainty about the positive role of vit. D in maintaining bone health and reducing the risk of many non-skeletal disorders, especially

in pregnant women[12].In many studies, the maternal use of vit. D supplementationhas shown to reduce complications and healthoutcomes associated with pregnancy[13]. However, some studies were inconsistent and showed no long-term association[14]. Pregnancy among adolescents is a public health issue that rises the concern in several countries worldwide due to adverse obstetric and perinatal consequences like preterm delivery, pre-eclampsia, small for gestational age (SGA), maternal and neonatal mortality[15]. Sufficient vit. Dconcentration is of particular importance in adolescent pregnant women for the optimized calcium (Ca) absorption, which is required to maintain bone health, which can have continuous effects on the mother and the newborns[16].

Serum calcifediol, 25- hydroxyvit. D [25-(OH)-D] concentration is widely acceptedand commonly measure to determine the deficiency and sufficiency of vit. D: however, still, there is no general agreement of optimal cut-off point values. The US Endocrine Society and the Institute of Medicine (IOM) describe deficiency of vit. D as having serum levels of 25-(OH)-D < 20 ng/ml (50 nmol/L), while concentrations between 20-30 ng/ml (50 and 75 nmol/L) are regarded as vit. D insufficiency and levels more than 30 ng/ml (75 nmol/L) are regarded as vit. D sufficiency. On the other hand, the National Osteoporosis Society consider serum concentration of 25-(OH)-D less than 12 ng/ml (30 nmol/L) as vit. D deficiency[17].

The US Endocrine Society recommends a vit. Dsupplementation of 600-2000 IU/D for daily intake during pregnancy, while IOM suggests a daily dose of 600 IU/D[18]. On the other hand, the American College of Obstetricians and Gynecologists (ACOG) indicates that there is notsufficient evidence about the optimal serum vitamin levels during pregnancy. They also do not support general screening of vit. D deficiency in all pregnant women[19].

Ethnicity also emerged as a strong predictor in defining vit. D status. In limited studies done in Saudi Arabia, most Saudi women possess sub-optimal vit. D levels throughout their reproductive phase of life[20]. These sub-optimal vit. D levels are further reduced during pregnancy because of higher dietary needs for the developing fetus[5]. Deficiency of vit. D is also common in other Arab and Gulf countries, where at the time of delivery, approximately 10–80% of pregnant women and as much as 40–80% of their newborns have sub-normal levels of serum vit. D. This suggests that there may be many other factors involved other than the sunlight exposure alone complicating the reason of vit. D deficiency in Saudi women[21].

This current research aims to find out the status of vit. D in Saudi pregnant women of the Al Jouf region and contributing factors that may lead to the deficiency of vit. D.

METHODS

Study Area: This study was carried out at the Department of Clinical Laboratory Sciences, College of Applied Medical Sciences, Jouf University, Sakaka, KSA, from January 2020-December 2020.

Sample Size: Thiscross-sectionalresearch was performed on 50 pregnant females separated into three groups based on the trimester of pregnancy. The first group were 6 pregnant females in the first trimester, second group were28 pregnant females in the second trimester and third group were 16 pregnant females in the third trimester. Women suffering from chronic disorders such as thyroid disorders, liver, and kidney disorders,which can affect 25-(OH)-D metabolism, were not included in this current study. A questionnaire was designed to collect the participants' demographic data, including age, trimester, intake of vit. D and calcium supplements, BMI, Sun exposure, daytime sun exposure, and sun exposure duration. Body mass index (BMI) was determined by the formula (body weight in kg/body height in m2). WHO criteria was used to define BMI Categories: (BMI 18-25 kg/m2 was considered as Normal, BMI 25-30kg/m2 was considered as Overweight, whereasBMI >30kg/m2 was considered as obese)[22].

Samples Collection: Sample collection was done from Women's Maternity & Children Hospitalin Al Jouf, (Sakaka). 5ml of Venousblood sample was collected in a yellow top gel vacutainer under ascetic sterilized conditions. Blood was allowed to clot at 37 ˚c in a water bath for 10 minutes, and then it was centrifuged for 10 minutes at 4000 rpm forseparation of serum, which was stored at -80 ˚C freezer until time of analysis.

Research Investigations

Serum 25-(OH)-D levels: Enzyme-linked immunosorbent assay (ELISA) was performed to determinethe serum 25-(OH)-D(ng/ml) concentration through ELISA Kit manufactured by Human Diagnostics (Germany). Manufacture guidelines were followed for ELISA performance, and Optical density (O.D) of standards and samples were taken at 450 nm by Bio Tek Synergy H4 ELISA plate reader. The standard curve was prepared on excel software using the O. D and concentration of standards. The concentration of samples was calculated with the help of a standard curve.

Statistical Analysis: Data was entered and analyzed using SPSS version 19. Demographic data was analyzed and presented as frequencies and percentages. To find out the relationship between categorical variables, the chi-square test was used. A p-value of ($p \leq 0.05$) was considered statistically significant.

RESULTS

Demographic data of Participants: A total of 50 pregnant Saudi women living in different areas of the Al Jouf region were included in this study. Majority of females (46%) were of age 20–30 years, whereas (42%) of females were of age 30-40 years, and only (12%) of females were of age <20 years. There were (12%) of the pregnant women in the first trimester,(56 %) in the second trimester, and (32%) were in the third trimester of pregnancy. While (38%) of the pregnant women were frequently exposed to the sun, only (14%) rarely had, and (4%) sometimes had sun exposure. Based on the sun exposure time, (12%) of the pregnant women were exposed to sun in the morning while (58%) in the midday and (3%) were exposed to sun in the evening. Daily sun exposure duration of less than 15 minutes was found in (64%) of pregnant women while (36%) pregnant women had sun exposure of more than 15 minutes daily. Results of the BMI showed that (42%) of pregnant women were obese while(30%) were overweight and (28%) were having normal BMI (Table I).

Table-I:Demographic data and the percentage of vit. D deficiency in pregnant women

Variables	Number of Participants(%)	Vit. D deficiency (%)	P-Value
Age <20 years 20-30 years 30-40 years	 6 (12%) 23 (46%) 21 (42%)	 14.2 % 42.9 % 42.9 %	.785
Trimester 1st 2nd 3rd	 6 (12%) 28 (56%) 16 (32%)	 14.3 % 51.4 % 34.3 %	.430
Sun Exposure Rarely Sometimes Frequently	 7 (14%) 24 (48%) 19 (38%)	 17.1 % 45.7 % 37.1 %	.068
Sun Exposure (daytime) Morning Midday Evening	 6 (12%) 29 (58%) 15 (30%)	 17.1 % 51.4 % 31.4 %	.419
Sun Exposure Duration (Daily) <15 Minutes 15 Minutes or more	 32 (64%) 18 (36%)	 65.7 % 34.3 %	.402
Maternal BMI Status 18-25 25-30 >30	 14 (28%) 15 (30%) 21 (42%)	 34.3 % 22.9 % 42.9 %	.273

p value of< 0.05 was considered as statistically significant.

Prevalence of Vit. D deficiency in Pregnant Women: Pregnant women (aged 20–30 years and 30-40 years) showeda high prevalence (42.9% and 42.9%) of vit. D deficiency in comparison towomen (aged <20 years, 14.3%) (Table I). Pregnant women in the 2nd trimester have more deficiency (51.4%) than the 1st (14.3%) and 3rd (34.3%) trimester. The preferable day time, duration, and frequency of sun exposure all significantly affected vit. D status.Pregnant women having frequent sun exposure were found to have low prevalence (37.1%) of vit. D deficiency as compared towomen being exposed to sun sometimes only (45.7%). Also, women having sun exposure in the morning (17.1%) and evening (31.4%) had low prevalence of vit. D deficiency as compared to women having sun exposure in the midday (51.4%). Pregnant women who had sun exposure for less than 15 minutes suffered more from vit. D deficiency (65.7%) than women with sun exposure of 15 minutes or more (34.3%). Additionally, obese pregnant females had a higher percentage (42.9%) of vit. D deficiency in comparison to overweight (22.9%) and normal weight (34.3%) (Table I).

Table-II:Vit. Dlevels in pregnant women

Variable	Mean (±SD)
Vit. D Level	17.27 (±6.51)
Variable	Participants'n (%)
Deficient	35 (70 %)
Insufficient	14 (28 %)
Sufficient	1 (2 %)

The mean level of vit. D was 17.27ng/ml with a range of (7.98–40.70ng/ml) (Table II). This study found70 %of pregnant women having deficient levels of vit. D (<20ng/ml), while 28 % having insufficient (20–30ng/ml)and only 2% having sufficient (>30 ng/ml)vit. Dlevels (Figure I).

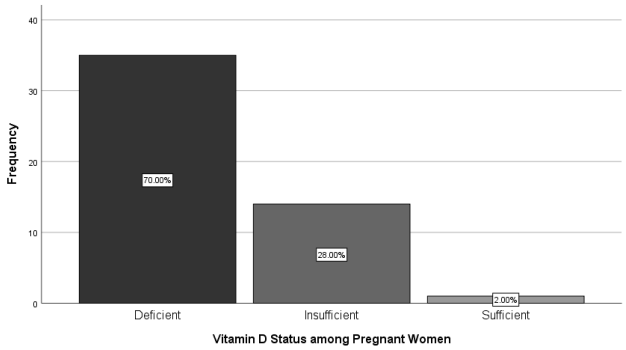

Figure-I:Bar chart showing vit. D levels in pregnant women; 70 % Pregnant women were deficient, 28 % were insufficient and 2% had sufficient vit. D levels.

DISCUSSION

Severe hypovitaminosis of vit. D is a public health issue that has been widely recognized and raised concern in many regions worldwide. Pregnant women and infants are among high-risk populations for vit. D inadequacy[23].The prevalence of vit. D deficiency has been documented in numerous reports in the KSA including healthy adults, especially women, based on the cut-off value of serum 25 hydroxy- Vit. D less than 20ng/mL as discussed in the introduction[17,24,25,26,27]. To our knowledge, this study is the first attempt to evaluate the prevalence of vit. D deficiency in pregnant women of the Al Jouf region, Kingdom of Saudi Arabia. The finding of this study revealed that 70% of the pregnant women who visited the Women's Maternity & Children Hospital in Al Jouf were vit. D deficient, 28% were insufficient, and only 2% were sufficient.

The impact of sunlight on vit. D status is wellrecognized as it is an essential source of vit. D synthesis in the human body[2].Despite the abundant sunlight in the region, the association between the vit. D status and the sun exposure behavior in this study revealed that the women exposed to the sunlight for less than 15 minutes were more vit. D deficient. Based on maternal BMI, obese pregnant women with a BMI greater than 30 showed a higher prevalence (42%) of vit. D deficiency than the overweight and normal body weight women. These finding support prior observations that obese females are most likely to be deficient in vit. D[25]. The study's results are consistent with the previous report of vit. D deficiency in a pregnant woman in Saudi Arabia[28].

A wide range of modifiable and non-modifiable factors, including environmental, social, cultural, and genetic factors, may contribute to the human body's vit. D status[10,29]. Investigators have reported that pregnancy alone could lead to vit. D deficiency in pregnant women[30]. Importantly, emerging evidenceindicates that the Low serum vit. D levels in pregnant women lead to various unfavorable health outcomes for the mothers and their infants. These health outcomes may include preterm birth, Cesarean delivery, or low birth weight[31].

Prenatal Vit. D supplementation was reported to significantly increased maternal 25(OH)D concentrations.

Therefore, many investigators have shown strong recommendations in taking diet and supplementation of vit. D during pregnancy to minimize the newborns' adverse health outcomes.The recommended daily dosage sufficient to obtain vit. D adequacy is not well determined as several factors affect the status vit. D[32]. Overall, the results obtained from this study suggest that most pregnant women in the Al Jouf region may need prenatal vit. D supplementation to ensure vit.D sufficiency and to avoid any complications to the newborns.

CONCLUSION

Our finding suggests that vit. D deficiency is prevalent in the pregnant females of the Al Jouf region. In this report, over 98% of participants pregnant womenhad vit. Ddeficiency or insufficiency. Our results showed that obese women and those with less than 15 minutes daily average sun exposure are more susceptible to vit. D inadequacy. Dietary intake and supplementations may be necessary for pregnant women and recommended during antenatal care. However, there is an urgent national need to establish the cut-off points for adequate vit. D amount ~~for~~ among general and subgroup populations such as the pregnant woman and newborns in the KSA through well-designed randomized clinical trials. Notably, the study's finding supports the urgent need to establish an evidence base guideline for vit. D intervention and appropriate recommended dosage.

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