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Vitamin D deficiency in pregnant women at a tertiary hospital in western sydney

Abstract

Background: Vitamin D deficiency in pregnant women has major health implications for both mother and child.

Aim: Our aim is to evaluate the prevalence of vitamin D deficiency and to determine if screening for vitamin D deficiency amongst our population is warranted.

Materials and Methods: This is an analysis of the vitamin D levels in pregnant women at Westmead Hospital. Vitamin D levels were categorised as, severe deficiency <12.5 nmol/L, moderate deficiency 12.5-24.9 nmol/L, mild deficiency 25-50 nmol/L, and sufficient > 50 nmol/L.

Results: Mild vitamin D deficiency was found in 38.3% of women, 6.5% had moderate deficiency, and 1.5% were severely deficient. The values of serum 25- Hydroxyvitamin D among women of Indian descent were significantly less than women from any other country (P <0.003).

Discussion: Our study population reflects the varied ethnic composition of pregnant women. This study has identified at risk population, and highlighted the severity of vitamin D deficiency, which has led to the establishment of a hospital protocol for screening antenatal women.

Keywords: Vitamin D deficiency, Pregnancy, Vitamin D supplementation

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Introduction

Vitamin D deficiency related complications have recently re-emerged as a major health issue in Australia.[1] The Australian population relies on exposure to ultraviolet B radiation in sunlight as a major source of vitamin D.[2] Known risk factors for vitamin D deficiency include dark skin pigmentation, covering of the skin due to cultural practices and exclusive breast-feeding beyond 6-12 months for at- risk age groups.[1,3,4] Vitamin D deficiency in pregnant women has major health implications for both mother and child. Recent evidence links vitamin D deficiency to adverse outcomes in pregnancy including preeclampsia, hypertension, higher rates of caesarean section and preterm delivery.[5] Lower serum 25- Hydroxyvitamin D (25(OH) D) levels have also been shown to be independently associated with poorer glycaemic control in women with gestational diabetes mellitus.[6] Several large cross-sectional studies have shown a positive relationship between serum 25(OH)D and insulin sensitivity, and an inverse relationship with risk of diabetes.[7-10]

The public health implications of vitamin D deficiency in pregnancy are broader than glycaemic control. The deficiency could lead to high bone turnover, bone loss, osteomalacia, and hypovitaminosis D myopathy in the mother.[11] Children born to vitamin D deficient mothers are at risk of developing rickets, oteomalacia, hypocalcaemic seizures, dilated cardiomyopathy, marrow fibrosis, disregulation of immune function and cellular differentiation and proliferation and type I diabetes.[1]

In Australia, recently immigrated children or first generation offspring of immigrant parents, especially those with dark skin, have a significantly higher incidence of vitamin D deficiency rickets than the overall Australian paediatric population. The most common presenting features include hypocalcaemic seizures and bowed legs. There is a steady increase in the number of cases of rickets per year diagnosed at Sydney Children's hospitals. The region of origin of these children is predominantly the Indian subcontinent followed by Africa and the Middle East.[1] Looking at the prevalence of vitamin D deficiency in refugees living in South-Western Sydney, the majority, 87%, were moderate to severely deficient.[2]

The emerging burden of rickets is particularly relevant to our population at Westmead as part of the Greater Western Sydney (GWS) Area. The GWS is the first point of arrival of largest refugee and migrant population in Australia. The GWS area represents over 200 nationalities.[12]

In light of this emerging evidence and the ethnic variance of our antenatal population, we undertook this study to determine vitamin D concentrations in women attending Westmead hospital for antenatal care. Our aim is to evaluate the prevalence of vitamin D deficiency and determine if screening for vitamin D deficiency amongst our population is warranted.

Materials and methods

This is a cross-sectional analysis of the serum 25(OH)D levels in pregnant women at Westmead Hospital, a tertiary level hospital in Western Sydney, NSW. Women were enrolled between June and August 2008, at booking-in appointment in the antenatal clinic. The total number of pregnant women recruited during this period was 226. However the data on country of birth was not available for 26 women.

Women were grouped according to country of birth into 5 categories, Australian, New Zealand or Pacific Islander, Indian Sub-continental, and South East (SE) Asian, Middle Eastern and others. In the study period, measurement of 25(OH)D was added to the routine antenatal screening. The level of 25(OH)D in serum is tested in our pathology laboratory using a chemiluminescence analyser.

Vitamin D levels were categorised as, severe deficiency <12.5 nmol/L, moderate deficiency 12.5-24.9 nmol/L, mild deficiency 25-50 nmol/L, and sufficient > 50 nmol/L.[1] The data was analysed using SPSS package (SPSS Inc., Chicago, IL, USA). Multiple variant analysis was conducted to show the association between serum 25(OH)D level, country of birth (COB), Body Mass Index (BMI), and mode of delivery (MOD). Two tailed Test (Chi-Square) with a significance level of 5% was used throughout. Ethical approval for this study was granted by the Western Sydney Local Health District Human Research Ethics Committee.

Results

During the study period between June and August 2008, 226 patients attended the antenatal clinic, all of whom consented to participate, 200 were analysed. Their mean age was 30 years, the median gestational age at delivery was 39.2 weeks, and BMI was 25.6. 38.5% were born in Australia, 24% Indian Subcontinent, 17.0% South East Asia, 9.5% Middle East, and 5.0% New Zealand/Pacific Islands. The median maternal serum 25(OH)D level was 52 (range 12-165) nmol/L. Mild vitamin D deficiency was found in 77(38.3%) of women, 13 (6.5%) had moderate deficiency, and 3 (1.5%) were severely deficient. 108 (53.7%) women had a sufficient serum 25(OH) D level.

Table 1 summarises the means of serum 25(OH)D levels in different country of birth groups. The distribution of vitamin D levels depends significantly upon country of birth ($p<0.001$) (Table 2). Women from SE Asia had a statistically significant lower vitamin d levels when compared to Australian born women. There was a statistically significant difference of category of vitamin D deficiency between Indians and women born in other countries. There was no significant difference amongst women from other countries of birth ($p <0.001$). Interestingly, despite a presumed higher proportion of darker skinned Pacific islanders, a relatively high mean level of vitamin D was noted.

The values of vitamin D among women of Indian descent were significantly less than women from any other country ($P <0.003$) in all cases. This did not change when adjusted for BMI. No statistically significant correlation was found between vitamin D levels and patient's BMI, gestational age or BSL levels. The information on mode of delivery was not available for all cases. We obtained information on 175 patients, which included 130 (74.3%) normal vaginal births and 45 (25.7%) caesarean sections. This study did not show association between levels of serum 25(OH)D, or severity of vitamin D deficiency and likelihood of caesarean section.

Discussion

The screening maternal vitamin D status, vitamin D supplementation during pregnancy and the effects of the deficiency on offspring are controversial. The importance of adequate vitamin D stores during pregnancy and the risk of vitamin D deficiency has been emphasised by multiple authority bodies in western countries including, UK Department of Health and Canadian Paediatric Society. However, the American College of Obstetrics and Gynaecology has not supported screening all pregnant women for vitamin D deficiency.[13] Literature suggests that high proportions, up to 70%, of otherwise healthy pregnant women have insufficient serum 25(OH)D concentrations.[14]

In Australia, a number of studies from different states have found varying prevalence of vitamin D deficiency in their population, and therefore have different protocols for screening and or treating vitamin D deficiency amongst their population of pregnant women. In one study, conducted at Cairns Base Hospital, no of the pregnant women tested for 25(OH)D levels were found to be deficient.[15] Conversely, In Canberra and Campbelltown Hospitals the prevalence of vitamin D deficiency or insufficiency was 35 and 25.7% respectively. Similarly, a study in Victoria found that 26% of their subjects were deficient and therefore support routine testing for all Australian women attending for antenatal care.[16]

Our study population reflects the varied ethnic composition of women attending for antenatal care at Westmead Hospital, with only 38.5% being born in Australia and 24% being born in the Indian Subcontinent. This finding is significant as our study demonstrates that the distribution of serum 25(OH)D level depends significantly on country of birth. Adults with dark skin require three to six times the amount of UVB compared with those with light skin to achieve similar serum 25(OH)D levels.[17] Furthermore, a study conducted in rural India with good sun exposure, found that seventy four percent of their pregnant women had vitamin D deficiency defined as levels <50nmol.[18] This corresponds to the findings in our study showing the values of serum 25(OH)D levels in our Indian women being significantly less than the values in women born in other countries.

Vitamin D deficiency has also been linked to an increase in primary caesarean section,[19] however our results have shown no statistically significant association between vitamin D deficiency and mode of delivery. Our study did not show any association between vitamin D deficiency and gestational age at delivery. However a recent study on spontaneous preterm birth < 35 weeks showed that among non-white mothers, higher serum 25(OH)D levels were associated with reductions in risk of spontaneous preterm births.[20]

Our study has several limitations. First, our data was collected via the Obstetrics database, which establishes a patient's country of birth rather than ethnic origin at the booking-in visit with the midwives. This may affect the demographic data obtained for those women who are born in Australia, but have ethnic heritage and therefore have different skin pigmentation, which would classify them in an at-risk category. However, this would potentially imply that a larger portion of our Australian born population would actually belong to the high risk category for vitamin D deficiency and therefore potentially emphasize the implications of this study. Another limitation is the lack of data on co-existing medical conditions or cultural practises, including choice of clothing like the veil or sunscreen usage, which could potentially affect vitamin d absorption.

This study has had a significant clinical impact on our practise at Westmead Hospital. It has identified our at risk population, and highlighted the severity of vitamin D deficiency. In view of the emerging evidence of the resurgence of rickets in our community, and the high prevalence of vitamin D deficiency (46.3%) amongst our antenatal women, we have drafted our first protocol (June 2013) for screening and management of vitamin D deficiency. This protocol entails, identifying at risk women, also screening all pregnant women and treating those found to be vitamin D deficient. Serum 25(OH) D levels are further tested at 36 weeks gestation for those with deficiency. Furthermore, it outlines the management and care of the neonates born to mothers previously vitamin D deficient. Currently, at Westmead Hospital, any neonate born to a mother who remains vitamin D deficient at 36 weeks gestation receives 400IU of vitamin D drops for the next 12 months. We recommend other hospitals do similar studies to look at the incidence in their own district population and therefore consider screening and treating for this major health problem.

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None.

Conflicts of interest

None.

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