



## Vitamin D deficiency in pregnant New Zealand women

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### Abstract

**Aim** This aim of this study was to identify the prevalence of vitamin D deficiency in pregnant women of a Wellington general practice where 10 cases of childhood rickets had been diagnosed over the past 3 years.

**Methods** Ninety pregnant women were screened for vitamin D deficiency by measuring 25-hydroxy vitamin D by DiaSorin radioimmunoassay. Recruitment into the study was over a 12-month period. A second appointment was arranged for clinical review and drawing of blood for parathyroid hormone, adjusted calcium, and alkaline phosphatase.

**Results** 100% of women presenting to the general practice for antenatal care consented to the study. 87% of women had 25-hydroxy vitamin D levels below 50 nmol/L. 61.2% of women had a vitamin D level below 25 nmol/L consistent with severe vitamin D deficiency. 10 women had an elevated parathyroid hormone consistent with secondary hyperparathyroidism. Only 22% of our patients were veiled, and included a diverse ethnic population, including African, Maori, European, Middle Eastern, and Polynesian women.

**Conclusions** Vitamin D deficiency is common in young pregnant women in this general practice, and it was not only confined to veiled women or women with dark skin. This highlights the magnitude of vitamin D deficiency in the pregnant population in a New Zealand setting; this vitamin D deficiency is responsible for the re-emergence of childhood rickets.

Vitamin D deficiency (and consequently rickets) is re-emerging as a major primary health care and public health issue throughout the world.<sup>1-5</sup> Although there is no true international consensus on the best ways to treat vitamin D deficiency, it is acknowledged that the prevalence of vitamin D deficiency and its associated morbidities are higher than previously thought worldwide.<sup>6-11</sup>

Nozza and Rodda from their review of children with rickets in Melbourne, Australia have recommended pregnant women with dark skin pigment or “veiling” should have their vitamin D level checked. If vitamin D levels are low (<50 nmol/L) then supplementation should be given to the mother as well as supplements to the breast feed infants of deficient mothers.<sup>3</sup>

During pregnancy and lactation, the current consensus is that the vitamin D status of the infant is strongly influenced by the vitamin D status of the mother during pregnancy. During pregnancy, 80% of the fetal skeleton is mineralised in the third trimester, so maternal adaptations to fetal calcium demands are most important in the third trimester. The major adaptive process in humans is a two-fold increase in maternal intestinal calcium absorption, mediated by increases in 1-25 dihydroxy vitamin D. Therefore the level of 25-hydroxy vitamin D and the parathyroid hormone

levels are felt to give the best indication of the body's balance of vitamin D during pregnancy.

Prompted by anecdotal reports of an increase in childhood rickets in South-East Wellington, we decided to examine the prevalence of vitamin D deficiency in a general practice population. Newtown Medical Health Services (NUHS) is part of a small Primary HealthCare Organisation (SECPHO) in South-East Wellington (latitude 41S) providing integrated medical and midwifery care for a population of approximately 7000 patients. Currently this includes a patient base of 437 children under the age of 5 years. Each year the number of births within the practice is approximately 120.

A review of their database for children under the age of 5 years identified 10 cases with a diagnosis of rickets over the last 3 years (Figure 1 and 2). Because of the re-emergence of childhood rickets in this practice, and in many countries around the world, a prospective clinical study was undertaken. We offered vitamin D screening for all pregnant women presenting for antenatal care to this general practice.

**Figure 1. Six-month-old child with rachitic changes showing expansion of the costochondral junction (arrowed)**



The study aim was to identify the prevalence of vitamin D deficiency in pregnant women of this small, busy primary health organisation (PHO). With an intention to treat vitamin D deficiency in order to prevent neonatal or childhood rickets in this population. We aimed to recruit 120 women to the study and replace vitamin D with ergocalciferol (vitamin D<sub>2</sub>) in those who were deficient from as early as 13 weeks gestation and continue this treatment throughout pregnancy and up to 6 months postpartum.

**Figure 2. Classic rachitic metaphyseal changes: cupping, fraying, widening, and fuzziness of the zone of provisional calcification immediately under the growth plate (arrowed)**



## Methods

In addition to the first antenatal bloods done routinely at commencement of maternity services, a 25-hydroxy vitamin D level was performed after consent was obtained. Each woman was asked to complete a simple dietary and sun exposure questionnaire. At the same time, an information sheet about vitamin D was provided and was available in several languages.

25-OH vitamin D was measured by acetonitrile extraction followed by DiaSorin radioimmunoassay (Stillwater, MN, USA). Patients with values less than 50 nmol/L were brought back for a further consultation and were considered to be significantly vitamin D deficient and offered replacement treatment.

At the second appointment, additional blood tests for parathyroid hormone (PTH), adjusted calcium, alkaline phosphatase, and phosphate were taken. Parathyroid hormone was measured by a Roche immunoassay (Basel, Switzerland). In pregnant women of 13 weeks gestation and over, with a vitamin D level of less than 50 nmol/L, ergocalciferol (vitamin D<sub>2</sub>) was prescribed as one 1,000 IU tablet per day. Follow up of the women later in pregnancy and in the postpartum period is the focus of the

continuing prospective study. Daily supplementation of 400–1000 IU/day in pregnancy is felt to be safe.<sup>1,12–16</sup>

The study received ethics approval from the Wellington Ethics Committee. Vitamin D in the form of ergocalciferol (vitamin D2) was purchased from New Hope Nutrition Ltd (Browns Bay, Auckland, New Zealand). The only active ingredient was vitamin D as ergocalciferol (vitamin D2) 1,000 IU (release limits 900–1650 IU).

## Results

To date, of the 90 pregnant women that have been seen at Newtown Union Health, 100% consented to be study participants. The community of this general practice is multicultural and was reflected in the diverse ethnic groups included in the study. Of the 90 pregnant women, 78 (87%) were vitamin D deficient—with 25-hydroxy vitamin D levels below 50 nmol/L. (See Table 1 below.)

**Table 1. Pregnant women (n=90) screened at Newtown Union Health (Wellington) for vitamin D deficiency**

Ethnicity	Number screened	Vitamin D deficient
Middle Eastern	15	15 (100%)
Indian	2	2 (100%)
African	21	18 (86%)
European	12	8 (67%)
New Zealand Maori	10	9 (90%)
Samoan	18	17 (94%)
Tokelauan	1	1
Chinese	3	2
Other	5	4
Cook Islander	2	2

Two patients with vitamin D levels above 50 nmol/L had had previous children with rickets and had been treated with vitamin D replacement before pregnancy. 25-OH vitamin D levels ranged from <7.5 to 112 nmol/L in the study group; 61.2% of women had a 25-hydroxy vitamin D level less than 25 nmol/L, 24.4% between 25 and 50 nmol/L, and only 14.4% had a level of 50 nmol/L or greater. Seventeen of 39 women who returned for their repeat blood testing had an adjusted calcium below the normal range of 2.25 mmol/L.

Amongst the 78 vitamin D deficient women, 10 had secondary hyperparathyroidism with a parathyroid hormone (PTH) of greater than 6.0 pmol/L (1.5–6.0 pmol/L). All those with a PTH of greater than 9.5 pmol/L had a 25-hydroxy vitamin D level less than 12 nmol/L.

## Conclusions

Deficiency of vitamin D is common in this general practice's (Newtown Union Health's) population of pregnant women. This practice does serve a diverse population and will not be the same for all other New Zealand general practices. However some of the significant findings include the high incidence of vitamin D deficiency (in our study group) in New Zealand Maori, Samoans, and other Pacific Islanders.

The African, Middle Eastern, and Asian groups showed a very high incidence of vitamin D deficiency, which was perhaps not unexpected. Secondary hyperparathyroidism and hypocalcaemia due to the vitamin D deficiency were also common, reflecting the severity of the deficiency.

Previously described risk factors for vitamin D deficiency include veiling with traditional dress. This only contributed to a minority of cases in our series with only 22% wearing veils. Sunlight exposure may also be related to the ability to sit outside for periods of time but only 33 of the 90 women were living in apartments.

In a general practice with a re-emergence of rickets in children, this study highlights the potential magnitude of this preventable disease. All these women have gone onto receive treatment where they have elected to continue with the pregnancy. Further follow up on the efficacy of treatment is planned.

Because of the high incidence of vitamin D deficiency in this group of pregnant women we seriously believe that further population studies are needed. It is also important to make midwives, general practitioners, endocrinologists, and obstetric medicine physicians aware that vitamin D deficiency is common in the pregnant patient.

Indeed, in our study population, vitamin D deficiency was not only common in the veiled and dark-skinned patients but among all ethnicities in our pregnant general practice population.

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