

Assessment of adequacy of vitamin D supplementation during pregnancy

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Skowrońska-Jóźwiak E, Adamczewski Z, Tyszkiewicz A, Krawczyk-Rusiecka K, Lewandowski K, Lewiński A. Assessment of adequacy of vitamin supplementation during pregnancy. *Ann Agric Environ Med* 2014; 21(1): 198–200.

Abstract

Introduction. Deficiency of vitamin D in pregnancy leads to higher incidences of preeclampsia, gestational diabetes, preterm birth, bacterial vaginosis, and also affects the health of the infants. According to Polish recommendations published in 2009, vitamin D supplementation in pregnant women should be provided from the 2nd trimester of pregnancy in daily dose of 800–1000 IU. The aim of the presented study is: 1) to estimate how many pregnant women comply with those recommendations and 2) to determine the 25(OH)D levels in pregnant women.

Patients and methods. The study included 88 pregnant women, aged 20–40 years, between 12–35 week of gestation. Vitamin D concentrations [25(OH)D] were measured by a direct electrochemiluminescence immunoassay (Elecsys, Roche).

Results. 31 of 88 pregnant women (35.2%) did not use any supplementation. Mean level of 25(OH)D was 28.8 ± 14.8 ng/mL (range from 4.0 – 77.5 ng/mL). Vitamin D deficiency, defined as 25(OH)D concentration below 20 ng/mL, was found in 31.8% of the women (28/88). Insufficiency of vitamin D [25(OH)D concentration between 20–30 ng/mL] was present in 26.1% of the women (23/88). Optimal level of 25(OH)D (over 30 ng/mL) was present in 37/88 (42.0% women). Hence, in 46.2% of women taking vitamin D supplementation, the levels of 25(OH)D were still below 30 ng/mL.

Conclusions. Supplementation of vitamin D in the investigated group was inadequate. More than 35% of pregnant women did not take any supplements, while half of the subjects who had declared taking vitamin D, failed to achieve optimal serum 25(OH)D concentration.

Key words

vitamin D, pregnancy, prophylactics, 25(OH)D

INTRODUCTION

Vitamin D3 (cholecalciferol) is not a vitamin in a true sense of the word, because the main source of vitamin D is skin synthesis, while less than 10% is derived from dietary sources [1]. The best known role of vitamin D is related to its effect on calcium homeostasis, in particular by increasing calcium absorption through amplification of calbindin synthesis, by the increased urinary calcium reabsorption; vitamin D is also involved in the regulation of parathyroid hormone synthesis [1].

Recently, non-skeletal effects of vitamin D have become the subject of interest [1, 2]. Potential extra-skeletal benefits of vitamin D intake include lower cardiovascular morbidity and mortality, the reduced risk of diabetes mellitus, colon cancer, multiple sclerosis, allergy, asthma and mental illness [3]. In addition to the above mentioned benefits, the adverse effects of vitamin D deficiency include rickets in children, bone fragility in adults caused by osteomalacia, osteoporosis and osteopenia [1].

During pregnancy, vitamin D regulates placental development and function [4], which suggests that maternal vitamin D status may be associated with adverse pregnancy outcomes, such as miscarriage, preeclampsia [5] and preterm birth [6]. Further risks of vitamin D deficiency in pregnant women include gestational diabetes [7] and

bacterial vaginosis [8]. Low vitamin D supply in pregnant women may affect their offspring, because there is a strong correlation between maternal and cord blood 25(OH)D, and newborns have inadequate vitamin D stores to draw on in early life [9]. Children of vitamin D-deficient women are at risk for developing respiratory infections and asthma [10], type-1 diabetes [11], and schizophrenia [12] in the elderly. Rickets, low bone mineral density, and reduced postnatal linear growth and weight gain may also occur, particularly if postnatal supplementation of vitamin D is insufficient [13].

In Polish children, seasonal differences in body size were demonstrated; children born in the period from October – April were taller and heavier than those born from May – September. The authors explain these results being caused by only minimal sun exposure in Poland during winter period, and – in consequence – the lowest vitamin D production, providing indirect evidence of vitamin D deficiency in Poland and its consequence for the newborns [14].

National consultants in the field of paediatrics, endocrinology, gynecology, and other experts, established the Polish recommendations for prophylactic vitamin D supplementation. According to those recommendations (2009), vitamin D supplementation in pregnant women should be provided from the 2nd trimester of pregnancy in a daily dose of 800–1000 IU in cases of inadequate intake from diet and/or skin synthesis [15].

The aim of presented study was: 1) to estimate how many pregnant women comply with these recommendations 2) to determine 25(OH)D levels in pregnant women.

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Received: 31 January 2013; accepted: 07 March 2013

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PATIENTS AND METHOD

The study included 88 Caucasian pregnant women, aged 20–40 years, between 12 – week of gestation. Samples were collected from March – October 2011. 25(OH)D concentration was measured by a direct electrochemiluminescence immunoassay (Elecsys, Roche). The design of study was approved by the Ethics Committee of the Medical University in Lodz. Characteristics of the investigated subjects is presented in Table 1. The data were analysed by means of simple descriptive statistics of location and dispersion and Mann-Whitney's U-test. Definition of vitamin D deficiency and insufficiency was based on the Endocrine Society's Practice Guidelines on Vitamin D [16].

Table 1. Characteristics of investigated women (n=88)

	Mean±SD	Median
Age [years]	31.44±4.70	32
Body mass [kg]	69.54±15.03	65
Height [cm]	165.30±5.77	165
BMI [kg/m ²]	25.89±5.19	24.20
Week of pregnancy	21.89±6.85	22

RESULTS

Thirty-one (35.2%) of the pregnant women did not use any supplementation. Mean level of 25(OH)D was 28.83±14.84 ng/mL (mean±SD), ranging from 4.0 ng/mL – 77.5 ng/mL. Vitamin D deficiency, defined as 25(OH)D concentration below 20 ng/mL was found in 31.8% of the women (28/88), while severe deficiency of vitamin D [25(OH)D concentration<10 ng/mL] was found in 4.5% of investigated women (4/88). Insufficiency of vitamin D [25(OH)D concentrations between 20–30 ng/mL] was detected in 26.1% of the subjects (23/88). Optimal levels of 25(OH)D (over 30 ng/mL) were found in 37/88 (42.0% of the women). 25(OH)D concentration was significantly higher in women taking vitamin D supplements, compared with women who did not take vitamin D supplements (33.17 ±13.72 ng/mL vs. 21.23 ±13.27 ng/mL; p<0.05).

In 46.2% of the women who used vitamin D supplements and in 83% who did not use vitamin D supplements, the levels of 25(OH)D were below 30 ng/mL. Relative proportions of pregnant women, classified according to their 25(OH)D status with regards to vitamin D users and non-users, are

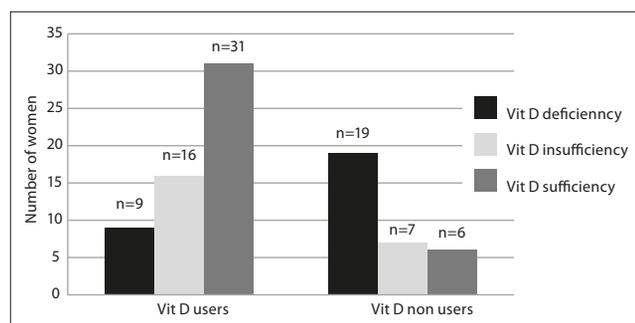


Figure 1. Relative proportions of 25(OH)D in women using and not using vitamin D supplements in pregnancy, classified as vitamin D deficiency [25(OH)D concentrations <20 ng/mL], vitamin D insufficiency [25(OH)D concentrations between 20–30 ng/mL], vitamin D sufficiency [25(OH)D concentrations over 30 ng/mL]

Table 2. Comparison of users (n=57) and non-users of vitamin D supplementation (n=31)

	Vitamin D supplementation users	Vitamin D supplementation non-users	p
No. of women(%)	57 (64,7%)	31 (35,2%)	-
25(OH)D [ng/mL]	33.17±13.72	21.23±13.27	<0.05
Age [years]	30.68±4.82	33±4.13	<0.05
Gestation week	21.6±6.9	22.76±6.8	NS
BMI [kg/m ²]	25.75± 5.28	24.96±5.1	<0.05
Weight [kg]	67.45±16.03	70.55±14.64	<0.05
Height [cm]	165.36±	165.18±6.14	NS

shown in Fig 1. While comparing the users and non-users of vitamin D supplementation, it was found that non-users were significantly older and had a slightly lower BMI (Tab. 2).

DISCUSSION

The results of the presented study indicate that in Poland vitamin D supplementation in pregnant women is not optimal. Namely, vitamin D deficiency occurred in 31.8% of investigated women, while only 63.6% of pregnant women used the supplementation in question. Moreover, despite the use of supplementation, in 44.6% of the women the levels of 25(OH)D did not reach 30 ng/mL, which constituted the goal of the supplementation according to the Polish recommendations [15]. To date, the adherence of Polish pregnant women to prophylactic recommendations has only rarely been investigated. There is only one study, in which authors analyzed the diet of 512 Polish pregnant women, and demonstrated a lower consumption of vitamins, including vitamin D (2.64 µg/daily vs. 15 µg recommended) [17]. In that study, 79.7% of the pregnant women used vitamin-mineral supplements. However, diet provides less than 10% of the vitamin D daily requirement, while the rest comes from skin synthesis [1, 16]. Vitamin D deficiency in pregnancy undoubtedly reflects the vitamin D deficiency in Poland [18]; however, vitamin D deficiency in pregnancy has also been previously demonstrated in other countries [7, 19].

Mean level of 25(OH)D in the patients in the presented study was 28.8 ng/mL. This was higher than that shown in Belgium (20.4–22.7 ng/mL, n=1311) [19], Denmark (23.0 ng/mL n=153) [7] and in South Australia (19.6 ng/mL, n=99) [20], although the last mentioned country is characterized by adequate sunlight, whereas in comparison with the presented data, the most similar results were reported from Canada, i.e. 25.6 ng/mL (n=226) [21].

In the presented study, severe deficiency of vitamin D [i.e. 25(OH)D <10 ng/mL] was found in only 4.5% of the investigated women, in contrast to 12.1% in Belgium [19], 32% in South Australia [20] and 1% in Canada [21]. In the present investigation, vitamin D deficiency, defined as 25(OH)D concentration below 20 ng/mL, was documented in 31.8% of subjects when compared to 44.6% in Belgium [19], 31% in Denmark [7] and 24% in Canada [21]. Higher 25(OH)D mean level, as observed here in comparison to other studies, may reflect seasonal variation of vitamin D, as our samples were taken from March–October.

The results also reflect ethnic homogeneity, as all subjects in the presented study were Caucasian, and there were no

Muslim women whose religious beliefs influence their dress code. The lack of these ethnic differences might be important, since subjects with darker skin tend to have lower 25(OH)D concentrations [9,19]. The self-reported character of data collection by pregnant women in the study may affect the accuracy of the information of the actual taking of vitamin D, the same applies to compliance with the rules of prophylaxis.

Deficiency of vitamin D in pregnancy, despite taking supplementation, may be a consequence of insufficient dose of vitamin D contained in multivitamin prenatal supplements, many of which contain only 400 IU or 500 IU, while Polish recommendations indicate that a dose of 400 IU is insufficient for providing an appropriate vitamin D status in pregnant women and their offspring. This may also explain the presented finding that 50% of the subjects who declared taking vitamin D, unfortunately failed to achieve optimal serum 25(OH)D concentrations. Similar data showing the ineffectiveness of a dose of 400 IU was shown by Vandevijvere [19] and Li [21]. However, compliance and persistence with the treatment should also be taken into consideration.

In conclusion, supplementation of vitamin D in the investigated group of Polish pregnant women was ineffective, since more than 35% of the pregnant women did not take any supplements, while almost 50% of the subjects who declared taking vitamin D failed to achieve optimal serum 25(OH)D concentration. Furthermore, physicians should be aware of the fact that supplements for pregnant women do not contain a sufficient amount of vitamin D.

Therefore, given the potential risk of vitamin D deficiency for pregnant women and their offspring, it is strongly recommend that randomized controlled trials on vitamin D supplementation during gestation should be performed.

Acknowledgement

The study was financially supported by the Polish Mother's Memorial Hospital – Research Institute in Lodz, Poland (Project No. 2011/V/2).

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