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## Evaluation of vitamin D status in pregnant women in Warsaw – preliminary report\*\*

### Ocena zaopatrzenia kobiet ciężarnych w witaminę D w aglomeracji warszawskiej – doniesienie wstępne

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#### Keywords

25(OH)D, vitamin D deficiency, supplementation, pregnancy

#### Słowa kluczowe

25(OH)D, niedobór witaminy D, suplementacja, ciąża

#### S u m m a r y

**Introduction.** Vitamin D deficiency is fairly common throughout the world, in all age groups. Whereas, in most countries there is still no accurate data providing detailed information on specific populations, especially pregnant women. The importance of the adequate dosage of vitamin D supplements in a group of pregnant women is pointed out in Recommendations of the Polish Gynaecological Society published in 2014, where the recommended dosage was increased to 2000 IU per day.

**Aim.** The aim of the study was to evaluate the vitamin D status in a group of pregnant women and to assess the intake of vitamin D supplements in relation to current recommendations.

**Material and methods.** Serum levels of 25(OH)D were measured in a group of 163 randomly selected women during the perinatal period. Information on maternal vitamin D intake was collected by questionnaire obtained during the perinatal period. Serum 25(OH)D levels were measured by chemiluminescence using a LIAISON (DiaSorin) analyzer.

**Results.** Nearly 15% of respondents did not supplement vitamin D in any form. Despite supplementation, the level of 25(OH)D in the peripheral blood remained below 30 ng/ml, which is considered the recommended minimum level, in almost 90% of women from studied group. Serum concentrations of 25(OH)D were closely correlated with declared doses of supplements.

**Conclusions.** The study indicates that the majority of pregnant women do not follow recommendations for vitamin D supplementation. Obstetricians should emphasize the importance of adequate vitamin D supplementation at the first follow-up visit during pregnancy. The pregnant women need to be advised to supplement vitamin D in recommended doses of 1500 to 2000 IU daily.

#### S t r e s z c z e n i e

**Wstęp.** Powszechny niedobór witaminy D obserwuje się na całym świecie, we wszystkich grupach wiekowych. Jednocześnie, w większości krajów wciąż brakuje danych opisujących precyzyjnie poszczególne populacje, zwłaszcza kobiet w ciąży. Na znaczenie odpowiedniego dawkowania suplementów witaminy D w grupie kobiet ciężarnych zwracają uwagę Rekomendacje Polskiego Towarzystwa Ginekologicznego z roku 2014, w których zwiększono zalecany poziom dawkowania do 2000 IU na dobę.

**Cel pracy.** Celem pracy była ocena zaopatrzenia w witaminę D w grupie kobiet ciężarnych oraz określenie spożycia suplementów witaminy D w odniesieniu do aktualnych zaleceń.

**Material i metody.** Grupę badaną stanowiły 163 losowo wybrane kobiety, u których w okresie okołoporodowym określono stężenie 25(OH)D we krwi obwodowej. Wielkość spożycia witaminy D w okresie ciąży oceniono na podstawie kwestionariusza wypełnianego przez ciężarną w okresie okołoporodowym. Oznaczeń stężenia 25(OH)D dokonywano

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za pomocą metody chemiluminescencji, w sposób zautomatyzowany, z wykorzystaniem analizatora LIAISON (DiaSorin).

**Wyniki.** Blisko 15% badanych nie suplementowało witaminy D w żadnej postaci. Mimo suplementacji, u prawie 90% badanych stężenie 25(OH)D we krwi obwodowej pozostawało poniżej poziomu 30 ng/ml, uważanego za rekomendowane stężenie minimalne. U badanych kobiet stężenie 25(OH)D w surowicy było ściśle skorelowane z deklarowanym poziomem suplementacji.

**Wnioski.** Przeprowadzone badanie wskazuje, że większość ciężarnych nie stosuje się do zaleceń dotyczących suplementacji witaminą D. Istotne jest zatem, aby położnicy już na pierwszej wizycie kontrolnej zwracali uwagę na włączenie do diety preparatu zawierającego witaminę D w rekomendowanej dawce 1500-2000 IU na dobę.

## INTRODUCTION

A high prevalence of vitamin D deficiency in populations of pregnant women gave rise to research about the role of vitamin D status and the importance of its deficit for the mother and the fetus. Vitamin D deficiency during pregnancy may be associated with higher risk of preeclampsia, pregnancy-induced hypertension, bacterial vaginosis and gestational diabetes (1). Hollis et al. (2) indicates that intake of adequate doses of vitamin D during pregnancy may significantly reduce the number of complications during pregnancy. The authors emphasize the relationship between low serum concentration of 25(OH)D, and the incidence of gestational hypertension and the percentage of cesarean sections. Note, however, that many pathologies are multifactorial and supplementation of vitamin D only, will not be sufficient to eliminate the problem.

A growing number of researchers points out an important role of vitamin D as a universal modulator of the immune system. This causes particular interest in the influence of vitamin D on immune processes during pregnancy. It has been shown that vitamin D deficiency is associated with a higher incidence of bacterial vaginosis, which increases the risk of miscarriages and premature births (RR 2.4 for pre-term births and RR 6.6 for miscarriages) (3, 4). Liu et al. (5) demonstrated in an animal model (mouse), that maternal and fetus concentration of vitamin D plays a key role in the development of chorioamnionitis. Vitamin D supplementation is therefore a potential therapeutic strategy influencing the immune system of a pregnant woman. Recommendations of the Polish Gynecological Society published in 2014, suggest that the currently used vitamin D dose of 800-1000 IU per day may be insufficient and recommend higher doses – up to 2000 IU daily (6). Hollis and Wagner (7) showed that women with profound vitamin D deficiency present before pregnancy, require much higher doses of vitamin D. The authors suggest that only 2000-4000 IU per day normalizes the vitamin D status in almost all pregnant women, and consequently reduces the number of complications, such as number of caesarian sections and some diseases associated with pregnancy.

## AIM

The main objective was an evaluation of vitamin D status in a group of pregnant women. Secondary objectives were to assess the compliance with recommendations of vitamin D supplementation during pregnancy and to evaluate the effectiveness of declared supplementation to obtain the desired concentration of 25(OH)D.

## MATERIAL AND METHODS

The study group included 163 randomly selected pregnant women admitted to Bielański Hospital on the day of delivery. Premature birth (before 37 completed weeks) and lack of written consent excluded from the study. The mean age in the study group at time of delivery was  $31.5 \pm 4.5$  years (mean  $\pm$  SD). Body weight measured at time of delivery was  $78.34 \pm 11.87$  kg (mean  $\pm$  SD), and body weight gain calculated in relation to the proper body mass reached  $15.62 \pm 11.19$  kg (mean  $\pm$  SD). Information on maternal vitamin D intake was collected by questionnaire obtained during the perinatal period. A 4 ml blood specimen was taken at the time of other routine blood examinations for 25(OH)D serum concentration testing. Levels of 25(OH)D were measured by chemiluminescence using a LIAISON (DiaSorin) analyzer. Statistical analysis was performed using IBM SPSS 23.0 software. In order to assess the compatibility of distributions with the normal distribution the Kolmogorov-Smirnov test was used. The relationship between variables was assessed using a Pearson coefficient (when the distribution was normal), and linear regression was used, along with a XY plot of the distribution and the least square regression line. In the case of variables of a distribution deviating from normal, a Spearman coefficient was used.

## RESULTS

Supplementation of one-component vitamin D preparation was declared by 42 included women (15.95%) and multi-component preparation with vitamin D by 113 women (59.51%). Usage of both types of vitamin D preparations de-

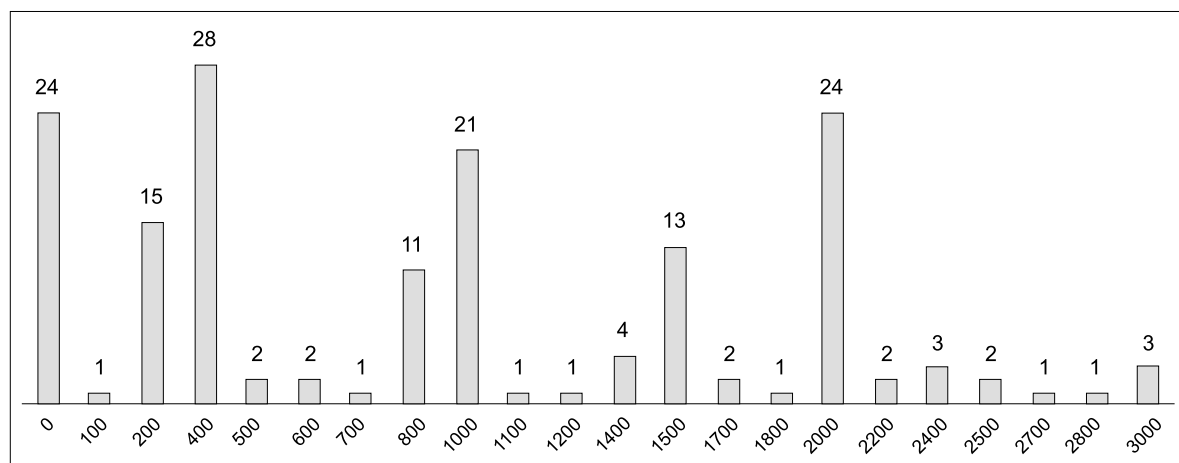
clared 16 patients (9.82%). In the studied group, 24 women (14.72%) did not supplement vitamin D in any form. The mean level of vitamin D intake was higher in the one-component vitamin D preparations (tab. 1). We found a high diversity of vitamin D supplemented doses. The most commonly applied dose during pregnancy was 400 IU taken by 28 (17%) of examined women. Whereas, only 52 pregnant women (32%) took doses over 1500 IU (fig. 1). There was significant statistically positive relation between the declared dose of vitamin D and measured 25(OH)D levels ( $r = 0.482$ ;  $p < 0.001$ ).

This relationship was statistically significant for one-component preparation ( $r = 0.307$ ;  $p = 0.046$ ), and the multi-component preparation ( $r = 0.306$ ;  $p = 0.001$ ). To evaluate the relation between dose of supplementation, and the serum concentration of 25(OH)D, the pregnant women were grouped according to the declared vitamin D intake. The concentration of 25(OH)D at the time of delivery was strictly dose-dependent in respective groups ( $r = 0.97$ ;  $p < 0.001$ ) (fig. 2). The level of 25(OH)D was classified as a deficiency  $< 20$  ng/ml, insufficiency: 20-29 ng/ml, sufficiency: 30-100 ng/ml.

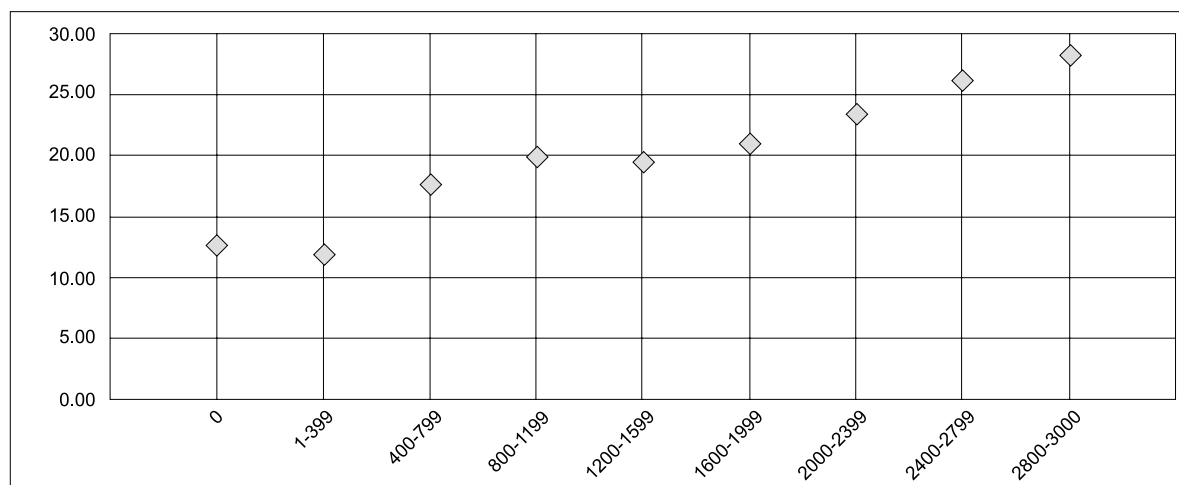
**Table 1.** Average level of vitamin D intake according to preparation type.

Vitamin D preparation type	Average	SD	Min.	Max.
Intake of vitamin D in one-component preparations (IU)	1261.90	576.34	500	3000
Intake of vitamin D in multi-component preparations (IU)	927.19	686.05	100	2400
Total intake of vitamin D in one-component and multi-component preparations (IU)	2023.53	649.55	1100	3000
Average intake of vitamin D (IU)	1141.73	761.38	100	3000

The mean concentration of 25(OH)D in the study group was  $18.5 \pm 8.35$  ng/ml (mean  $\pm$  SD), minimum 4.5 ng/ml, the maximum 44.0 ng/ml. The concentration below 20 ng/ml was found in 96 women (58.9%) out of which in 26 patients (15.95%) remained below 10 ng/ml. Insufficient levels were found in 50 examined women (30.67%). Only 17 (10.43%) had sufficient level of 25(OH)D (fig. 3). There was no significant association



**Fig. 1.** Number of women receiving various doses of vitamin D.



**Fig. 2.** Mean levels of 25(OH)D among pregnant women grouped according to supplementation level (by steps of 400 IU).

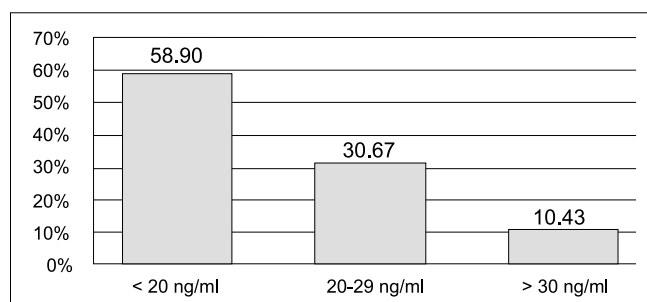


Fig. 3. Vitamin D status among pregnant women.

between serum concentration of 25(OH)D and body mass on the day of delivery ( $r = -0.105$ ;  $p = 0.180$ ). The weight gain during pregnancy was calculated in relation to proper body mass. We found no statistically significant relationship of the weight gain and serum 25(OH)D concentrations ( $r = -0.137$ ;  $p = 0.082$ ).

## DISCUSSION

Our study found a high prevalence of vitamin D deficiency in a group of pregnant women living in Warsaw agglomeration. On the day of delivery only about 11% women showed expected concentrations of vitamin D exceeding 30 ng (8). These results are consistent with other studies in different populations of pregnant women. Maghbooli et al. (9) demonstrated that in the group of 552 Iranian pregnant women, examined on the day of delivery, only 3.4% had levels of 25(OH)D greater than 30 ng/l. The mean concentration of 25(OH)D was  $11.14 \pm 8.7$  ng/ml (mean  $\pm$  SD). This study also failed to show an association between weight gain during pregnancy and the concentration of 25(OH)D. In the group of 125 Finnish pregnant women vitamin D deficiency was found in 96% of patients. The mean concentration of 25(OH)D was  $18.03 \pm 4.8$  ng/ml (mean  $\pm$  SD). Intake of vitamin D at a dose of  $264 \pm 192$  IU (mean  $\pm$  SD) as supplements reported 80% of patients. The total intake of vitamin D from the diet and supplements in this group was  $572 \pm 232$  IU (mean  $\pm$  SD). Even such small vitamin D intake was positively correlated with serum 25(OH)D, but the majority of women did not achieve expected 25(OH)D concentrations (10). Similar results were obtained in Belgian

study, where the mean concentration of 25(OH)D on the day of delivery was  $16.6 \pm 12.7$  ng/ml (mean  $\pm$  SD). In this group, 75% of women reported vitamin D supplementation at a dose of 400 IU. Surprisingly, the Belgian authors reported no significant correlation between this dose and 25(OH)D levels (11). Thus may confirm the need for higher dosage of vitamin D during pregnancy. Hollis and Wagner suggest that only supplementation with 2000-4000 IU of vitamin D (depending on the baseline value) can provide a desired concentration of 25(OH)D during pregnancy (7). Most of the studies confirm a need for higher (than previously recommended) doses of vitamin D during pregnancy. This gave support to the current recommendations of the American Endocrine Society published in 2011 (12) and Polish recommendations published in 2013 (8) which recommend 1500 to 2000 IU per day for all pregnant women. Our results shows that even intake of the currently recommended doses do not provide the optimum concentrations of 25(OH)D at the time of delivery in all pregnant women. Intake of higher doses, such as proposed by Hollis, requires further studies. More precise adjustment of the dosage of vitamin D in pregnancy was suggested by Australian researchers (13). They took in account the impact of the baseline level of 25(OH)D before pregnancy and the impact of obesity on vitamin D metabolism, they advise to measure the level of 25(OH)D at the diagnosis of pregnancy. The indication for such screening tests should be: expected low exposure to the sun, dark skin color and BMI > 40 (13, 14).

## CONCLUSIONS

The performed research shows that most of pregnant women do not follow the recommendations for vitamin D supplementation. Obstetricians should therefore pay attention, already on the first follow-up visit, to emphasize the importance of vitamin D supplementation at recommended doses of 1500-2000 IU per day. In groups of high-risk vitamin D deficiency the measurement of 25(OH)D levels should be proposed at the diagnosis of pregnancy. Therefore, the supplementation dose should be closely adapted to the current level of 25(OH)D.

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