

Assessment of Vitamin D Status in Mothers and their Newborns: Algerian Series

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Abstract

Summary: The evaluation of the vitamin D status can be easily carried out by the determination of the serum 25OHD which reflects the vitamin stocks. In the newborn, the vitamin status depends entirely on that of the mother. Maternal vitamin D stores can sustain infant requirements for the first 6 weeks of life only if maternal vitamin D status was adequate at the end of pregnancy, which is often not the case. No study has been carried out in Algeria concerning the prevalence of vitamin D insufficiency in newborns and their mothers, we propose through this work to evaluate the status of a series of newborns and their mothers.

Results: The analysis covers 100 newborns and their mothers recruited during the 4 seasons. The average age of the mothers was 28 years and 6 months, with a standard deviation of 5 years and 3 months. 95% of the population studied wore covering clothes. The average age of newborns was 3 days \pm 1 day. The sex ratio was 2. The average total vitamin D level of these mothers was 8.5 ± 3.3 ng/ml, significantly lower than current recommendations (25 OHD > 20 ng/ml) with an average PTH level of 97 ± 6.7 pg/ml. The average total vitamin D level of their newborns was 15.3 ± 2.8 ng/ml, significantly lower than current recommendations (25 OHD > 20 ng/ml) with an average PTH level of 63.9 ± 4.8 μ g/ml. The risk of vitamin D deficiency is associated with individual factors (wearing covering clothing), lifestyle habits (lack of sunshine, insufficient dietary intake of vitamin D) and environmental factors (season). A statistical correlation significant was found between the mean serum concentration of vitamin D of the mother and the serum concentrations of vitamin D in her newborn (The lowest

levels of vitamin D were found in mothers who had a low level of vitamin D). There was a statistically significant negative correlation between mean serum vitamin D concentration and PTH concentrations in mothers and their newborns.

Conclusion: A targeted preventive action through vitamin D supplementation in the 3rd trimester of pregnancy seems necessary in order to prevent serious consequences for the mother and her newborn.

Keywords: Vitamin D; Deficiency; Mother; Newborn; Algeria

Introduction

Vitamin D has recently experienced a spectacular revival of interest, due to its "classic" bone effects, but also extra-bone [1,2]. Vitamin D exists in two forms: vitamin D2 or ergocalciferol produced by plants and vitamin D3 or cholecalciferol produced by animals. Vitamin D is transported to the liver where it is hydroxylated to 25-OH vitamin D or calcidiol. Transported by the bloodstream to the kidney, 25-OH vitamin D undergoes a second hydroxylation there to 1, 25-(OH)₂ vitamin D or calcitriol, the biologically active hormonal form of vitamin D. The evaluation of vitamin D status can be easily carried out by the dosage of serum 25 Hydroxyvitamin D (25-OH-D) which reflects vitamin stocks. Nevertheless, questions remain in daily clinical practice.

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They relate to thresholds considered normal or more exactly "desirable". The threshold of 75 nmol/l (30 ng/mL) is currently proposed as a reference in terms of bone benefit, but higher levels may be necessary for obtaining certain extra-osseous effects [3-6]. In recent times, the minimum satisfactory concentration of vitamin D was defined as that which prevents the occurrence of deficiency rickets in children and osteomalacia in adults, i.e. approximately 8 ng/mL (20 nmol/L) [7]. However, in 2010, most international experts agree to set the limit values for adults. between 10 and 20 ng/ml (25 and 50 nmol/L) as a "deficiency" and less than or equal to 10 ng/mL (≤ 25 nmol/mL) in vitamin D, as a "deficiency" threshold, below which the risk of pathological bone consequences in the short term is significant. For children, there is no consensus and it is considered that a minimum serum concentration of 20 ng/mL is necessary [8].

Whatever threshold is used, all studies demonstrate a high prevalence of vitamin D insufficiency, estimated at between 30 to 80%, in different populations and at various latitudes [7,9,10]. In the newborn, the vitamin status depends entirely on that of the mother. Maternal vitamin D stores can sustain infant requirements for the first 6 weeks of life only if maternal vitamin D status was adequate at the end of pregnancy, which is often not the case. The prevention strategies adopted in Algeria consist in administering 1 vial of 200,000 IU of vitamin D3 at 1 and 6 months to fight against rickets. There is no supplementation for pregnant women or children beyond the age of 6 months. The prevention strategy currently followed seems satisfactory, insofar as deficiency rickets is practically no longer observed in our country, however there are very few studies concerning the evaluation of vitamin D status in healthy children. No study has been carried out in Algeria concerning the prevalence of vitamin D insufficiency in newborns and their mothers, we propose through this work to evaluate the status of a series of newborns and their mothers.

Methodology

Cross-sectional, prospective, descriptive and unicentric survey, carried out at the level of our pediatric department of the Hussein Dey university hospital center. To take seasonality into account, the study took place over one year: January 1, 2017-January 1, 2018. The sample was formed according to a random survey by simple draw by numbering (statistical method validated by the WHO). Recruitment was carried out chronologically and consecutively with a similar workforce during the 4 seasons after obtaining the written and signed consent of the parents.

Inclusion Criteria

- Healthy pregnant women giving birth to a live child, at term, at the level of the above-mentioned structure.
- Have not received any treatment with vitamin D or calcium during the 3rd trimester of pregnancy.
- Not receiving any treatment at the time of sampling that could interfere with vitamin D metabolism or calcium phosphate metabolism.

Organization of the Study

D status, such as their food and clothing habits, their exposure to the sun. PTH was performed as well as in their newborns. The pre analytical factors of the vitamin D assay have been taken into consideration. 25OHD is more stable in serum than in plasma. It must be dosed on the serum. The stability of 25OHD in serum makes special precautions unnecessary for the storage of samples. Vitamin D is degraded relatively quickly by light, oxygen and acids. It must, therefore, be stored in opaque and hermetically sealed bottles. The total 25 OH D was measured in serum by electrochemiluminescence (automate elecsys 2010) at the level of the biochemistry laboratory Center hospitalo universitaire d'Hussein Dey. The results were interpreted according to the standards of the recommendations of the American Society of Endocrinology [11]. The PTH assay was performed by the Cobas e411 Roche diagnostic analyzer. Apart from the concentration of 25OHD and PTH. Other biological parameters were studied: Calcium expressed in mg/l, phosphoremia expressed in mg/l, albumin and creatinine expressed in g/l. These parameters were measured by an Xpend Siemens automaton. The evaluation of the level of vitamin D must be accompanied by the determination of calcemia, phosphoremia, albuminemia and cretinemia. Any abnormalities in these parameters make the vitamin D level incorrect. The biochemistry unit carries out daily internal quality control before any validation of the results. The acceptable coefficients of variation in the laboratory are less than 3% of the recommended target regardless of the measured parameter.

Statistical Analysis

All questionnaire data was collected using SPSS 22 software. First, we carried out a descriptive analysis of the study population. In a second step, a univariate analysis was carried out in order to determine what could be the factors influencing the variations in the level of 25(OH) vitamin D of the patients included. Individual factors (wearing covering clothes), lifestyle (lack of sunshine, insufficient dietary intake of vitamin D) and environmental factors (season) were evaluated by questionnaire, their association with a risk of hypovitaminosis D was studied by logistic regression. The significance level of the statistical tests and the simple and multiple logistic regression is $p < 0.05$.

Results

The analysis covers 100 newborns and their mothers recruited during the 4 seasons. The average age of the mothers was 28 years and 6 months, with a standard deviation of 5 years and 3 months. 95% of the population studied wore covering clothes. The average age of newborns was 3 days ± 1 day. The sex ratio was 2. The evaluation of dietary vitamin D intake is difficult to carry out, there is currently no self-questionnaire allowing the correct estimation of exogenous vitamin D intake. The adopted questionnaire is mainly based on the Ciqual table which allows estimation of dietary vitamin D intake from a dietary survey based on consumption of milk and other dairy products (yogurt, cheese, butter and margarine), oily fish and eggs. The vast

majority of mothers (80%) had dietary intakes of vitamin D between 100 and 200 IU/d. Only 2% of mothers had a daily dietary intake of vitamin D greater than 200 IU/ day.

The average daily dietary intake of vitamin D was estimated at 122 IU/day with extremes between 70 and 230 IU/ day. The clinical examination of the mothers and their newborns did not find any signs of hypovitaminosis D. Calcium, phosphoremia, albuminemia and creatinine levels were normal for both groups (mothers and their newborns). The results of blood assays for total 25 OHD and PTH are presented in the following **Table 1**.

Parameters	25 OHD (ng/ml)	PTH(pg /ml)
Mothers	8.5 ± 3.3	97 ± 6.7
Newborns	15.3 ± 2.8	63.9 ± 4.8

Table 1: Hormonal balance.

The average total vitamin D level of these mothers significantly lower than current recommendations (25 OHD > 20 ng/ml) with an average PTH level of 97 ± 6.7 pg/ml . The average level of total vitamin D of their newborns significantly lower than current recommendations (25 OHD> 20 ng/ml) with an average level of PTH a 63.9 ± 4.8 pg/ml.

The risk of vitamin D deficiency is associated with individual factors (wearing covering clothing), lifestyle habits (lack of sunshine, insufficient dietary intake of vitamin D) and environmental factors (season). A variation in serum vitamin D concentration depending on the season, with a lower concentration in winter. A statistically significant correlation between the average serum vitamin D concentration and the vitamin D intake, the wearing of protective clothing in the mothers were found. We also demonstrated a statistically significant correlation between the mother's mean serum vitamin D concentration and the serum vitamin D concentrations in her newborn (The lowest vitamin D levels were found in mothers who had low vitamin D. There was a statistically significant negative correlation between mean serum vitamin D concentration and PTH concentrations in mothers and their neonates, indicating a degree of bone resorption that may have deleterious consequences in the absence of treatment (hypocalcemic convulsions, heart rhythm disorders, laryngospasm, fractures, etc.), the mothers and their newborns in our series were asymptomatic. The inflection point corresponds to the concentration of vitamin D necessary for the maximum suppression of secondary hyper parathyroidism, this inflection point is variable according to the different works: 30 to 100 ng/ml. In order to define the concentration of 25 OHD below which a suppression of the level of PTH can be observed, we took into account the regression function of PTH with respect to 25 OHD. The estimation of the inflection point is carried out using the parametric regression method of LOWESS which makes it possible to determine the form of scattering of two continuous variables. This inflection point was at 34.1 ng/ml in our study [Figure 1].

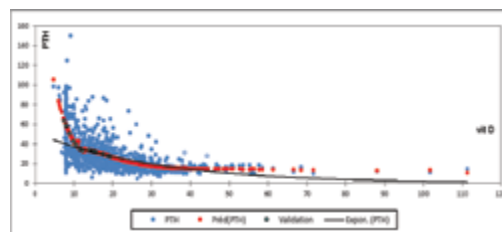


Figure 1: Lowess fit curve.

Discussion

In the newborn, the vitamin status depends entirely on that of the mother. Maternal vitamin D stores can sustain infant requirements for the first 6 weeks of life only if maternal vitamin D status was adequate at the end of pregnancy, which is often not the case. The characteristics of the populations studied in the literature were different from those of our population, in particular in terms of age, period of study, latitude, ethnic origins, lifestyles, all the time a deficit in vitamin D has been well demonstrated in pregnant women at the end of their pregnancy, especially when the last trimester of pregnancy takes place in winter and early spring [12-15], even in cities as sunny as Marseille [16] or Nice [17] or when women are forced to stay in bed during pregnancy and have not received sufficient supplementation . In Northern Ireland, 75% of pregnant women had vitamin D insufficiency and 16% had a deficiency [18]. In Norway, a multicenter study, including 86 immigrant pregnant women from Pakistan, Turkey and Somalia, 57% of women had vitamin D levels below 25 nmol/L and 15% below 12 nmol/L [19]. Studies have shown a relationship between this poor vitamin D status and the frequency of late or even early neonatal hypocalcemia accidents [20,21].

Bassir, in his study, carried out in 2001, showed in a population of Iranian pregnant women very low or zero circulating levels of plasma 25(OH)D in 80% of the population studied (57 women). Newborns had low or undetectable levels with biological signs of osteomalacia (raised circulating PTH and alkaline phosphatase); moreover, the neonatal adaptation of calcium metabolism is disturbed with severe and lasting neonatal hypocalcemia [22]. In sunny Jordan, a nationwide study [23] of 2013 women of childbearing age found a deficiency (<12 ng/ml) in 60.3% (95% CI: 57.1 to 63.4%) and deficiency (<20 ng/ml) in 95.7% (95% CI: 94.4-96.8%). The prevalence of deficiency was significantly higher in urban women and women who wore a headscarf. Wearing covering clothes could be an aggravating factor. In vitro [24] and in vivo [25,26] work has been carried out to study the influence of covering clothing on the serum concentration of vitamin D. The in vitro study has highlighted the impact of direct luminosity on the cellular synthesis of previtamin D from 7-hydrocholesterol. The synthesis of pre-vitamin D varied according to the type and thickness of the fabric, with zero cell production when the solar attenuation was total (use of a black polyester fabric, very often used for making clothes) [24]. A comparative Turkish study [25] revealed the existence of an increased risk of vitamin D deficiency depending on clothing style. Mean serum vitamin D concentration was significantly lower in the group wearing covering clothing.

Conclusion

Our work has highlighted the state of hypovitaminosis D in a young population, usually in good health and of childbearing age, and the impact on newborns. Efforts remain to be made in the diagnosis and their management. A targeted preventive action through vitamin D supplementation in the 3rd trimester of pregnancy seems necessary in order to prevent serious consequences for the mother and her newborn.

Declaration of Interests

No conflict of interest

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