**Vitamin D status of infertile women in Abidjan, Côte d'Ivoire**

**ABSTRACT**

**Background:** Long known for its role in phosphocalcic metabolism, vitamin D has been attracting growing interest in recent years for its involvement in numerous physiological processes, including its essential role in reproductive health.

According to many authors, vitamin D is involved in biological processes crucial to fertility, such as the production of sex hormones (progesterone and estrogen), promoting oocyte maturation and increasing endometrial receptivity for successful implantation. Inadequate vitamin D levels would therefore have a negative impact on fertility. This study determined the vitamin D status of infertile women in Abidjan.

**Methods:** This was a descriptive cross-sectional study conducted from June 2023 to September 2024. It included 102 infertile women, aged 21-50 years, consulting a specialized clinic in Abidjan and having given their consent to participate in the study. Serum vitamin D [25(OH)D] levels were measured on the Vidas PC®, and the prevalence of hypovitaminosis D (levels < 30 ng/ml) was determined.

**Results:**

The mean age of the patients was 37±6 years. The mean vitamin D level in the infertile population was 24.07 ± 7.69 ng/ml.

The prevalence of hypovitaminosis D (level < 30 ng/ml) was 81.37%.

Only 18.63% of women had optimal serum vitamin D levels (30-100 ng/ml).

**Conclusion:** The prevalence of hypovitaminosis D in infertile women in Abidjan is high (81.37%). These results highlight the need to monitor and correct vitamin D levels in infertile women for better management of fertility disorders.

*KEYWORDS : Vitamin D, Prevalence, Hypovitaminosis D, infertility*

**Introduction**

According to the World Health Organization (WHO), over 17% of the world's population of childbearing age suffers from infertility (1,2), with an estimated prevalence of 13.1% in Africa (3). In Côte d'Ivoire, according to some studies, the prevalence of infertility integrating all parameters is around 15.1%, with female infertility estimated at 58.6% (4,5).

Infertility, defined as the inability to achieve pregnancy after 12 months or more of regular unprotected sexual intercourse without contraception (3,6), has become a major public health problem and a matter of great importance for many couples wishing to start a family.

Among the many factors influencing the ability to conceive, one nutrient, vitamin D, is attracting increasing interest due to its potential effects on reproductive health (7–16).

In recent years, a number of authors have focused on the effects of vitamin D on the female reproductive system, given the presence of vitamin D receptors and metabolizing enzymes in certain organs such as the ovaries, endometrium, fallopian tube epithelium, placenta, decidual cells, hypothalamus and pituitary gland (17,18). These authors have shown that adequate levels of vitamin D could help improve fertility in both men and women, notably by stimulating the synthesis of female hormones involved in reproduction and in maintaining pregnancy in women (7–16,19–28).

The action of vitamin D in endometrial activity is due to its various biological effects, in particular its involvement in phospho-calcium metabolism, as well as its anti-inflammatory and anti-proliferative effects (29).

Vitamin D also acts on the female reproductive system, particularly in ovarian tissue, by increasing the production of progesterone and estradiol, thus stimulating folliculogenesis (30). In the field of Medically Assisted Reproduction (MAP), vitamin D could modulate the pregnancy rates obtained in IVF (14,15).

Its deficiency or hypovitaminosis D is therefore likely to lead to bone metabolism pathologies as well as infertility-related disorders (30–35).

In sub-Saharan Africa, and particularly in Côte d'Ivoire, there are few data available on vitamin D levels in the population of women who consult a physician because they want to have children or because they are infertile.

The aim of this study was to describe the vitamin D status of patients who consult us to the clinic because they want to have children or because they are infertile, in order to optimize their treatment under medically assisted procreation (MAP).

**Materials and methods**

**Framework and study topics**

This was a descriptive cross-sectional study initiated by the Biochemistry Laboratory of the Pharmaceutical and Biological Sciences UFR, Félix Houphouët-Boigny University, Abidjan, Côte d'Ivoire, in collaboration with a center specializing in assisted reproduction for patient recruitment and the laboratory of the Abidjan Heart Institute for assays. It included 102 female patients aged between 21 and 50, who came to the said center for maternity consultations, during the period from June 2023 to September 2024. Each patient gave her consent to participate in the study.

**Method**

Each patient was asked to complete a survey concerning age, medical and surgical history, duration of infertility and whether she had ever been treated for infertility.

Blood samples were taken by venipuncture at the patient's elbow, in anticoagulant-free tubes for vitamin D assay. The assay was performed using the Enzyme Linked Fluorescent Assay (ELFA), a competitive enzyme-linked immunosorbent assay with final fluorescence detection, on the Vidas PC®.

Sociodemographic (age, weight, body mass index), clinical and biological data were recorded using an Excel file. Statistical processing was performed using XLStat software. The variable measured was serum 25(OH) vitamin D concentration.

**Results**

The mean age of the patients was 37±6 years, with extremes ranging from 21 to 50 years. This population is representative of women of childbearing age, and the average duration of infertility was 5 years.

Analysis of the various vitamin D assays showed a general trend towards hypovitaminosis D in this population of infertile women. Vitamin D concentrations ranged from 8.1 ng/ml to 44.4 ng/ml, with a mean of 24.07 ± 7.69 ng/ml.

The breakdown of serum vitamin D concentrations into two categories: hypovitaminosis (deficiency and insufficiency) and optimal vitamin D levels, identified eighty-three (83) women with hypovitaminosis D (ITV D < 30 ng/ml) and 19 women with optimal vitamin D levels (ITV D ≥ 30-100 ng/ml) (Table 1).

Table 1 : Distribution of women according to vitamin D status

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Serum 25(OH) Vit D (ng/ml)** | **Number of women****(n=102)** | **Prevalence (%)** | **Mean (ng/ml)** | **Standard deviation** |
| < 10 ng/ml (deficiency) | 4 | 3,92 | 8,62 | 0,86 |
| 10-30 ng/ml (Insufficiency) | 79 | 77,45 | 22,17 | 5,05 |
| 30-100 ng/ml (Optimal) | 19 | 18,63 | 35,22 | 4,67 |

Use of the SPEARMAN matrix showed that there was no correlation between age and vitamin D levels in these infertile women (Table2).

Table 2 : Statistical analysis using the SPEARMAN correlation matrix

|  |  |  |  |
| --- | --- | --- | --- |
| Parameters to be correlated | P-value | T-student |  Determination coefficient |
| Age | 0,626 | 0,489 | 0,002 |
| Vitamine D levels |
| Tablerence | <0,01 | >0,05 | >5 |

**Discussion**

The average age of the patients was 37, with extremes ranging from 21 to 50 years, corresponding to the age at which ovarian reserve begins to decline. These data are similar to those reported in the literature: in fact, Kannamannadiar and al. in 2008 (36) in a study in Nottingham (UK) of patients undergoing MAP found an average age of 33.7 years. In 2012, ML Hauhouot-Attoungbré and al. reported an average age of 35 years in a study carried out in Abidjan (37). Trably C. and al. (38) found an average age of 33.7 years in France in 2012. In contrast, Moreira and al. (39) found an average age of just 24 years infertile women undergoing MAP in Dakar. These results show that women turn to MAP relatively late in life. Giulia Ranzanici and al. (40) have shown that socio-cultural factors such as education, professional ambition and idealization of the family have a predominant effect on the tendency to delay the age of first pregnancy until the third decade. These factors would constitute a poor prognosis for a desire for motherhood. In fact, according to Philippe Merviet and al. (41), the follicular population falls by 75% between the ages of 30 and 40, with a drop in fertility at 35 from 25% to 12%.

Women with severe vitamin D deficiency had a mean age of 38 ± 5 years, slightly higher than that of women with vitamin D insufficiency (37 ± 6 years). This difference was not statistically significant. These results suggest that hypovitaminosis D uniformly affects women of childbearing age, regardless of their age group.

Consideration of age alone as a demographic factor is not sufficient, and it is necessary to extend investigations to other socio-demographic factors for a complete assessment of hypovitaminosis D.

**Prevalence of hypovitaminosis D**

Hypovitaminosis D (vitamin D deficiency and insufficiency) affects many populations worldwide and has been reported in the healthy population of all age groups and both sexes (30,35). Its prevalence in women of childbearing age appears to be increasing worldwide in recent decades (42,43).

Of particular concern is the 81.37% prevalence of hypovitaminosis D (vitamin D levels <30 ng/ml) observed in infertile women in our study. These results confirm observations made in similar studies around the world, notably those by Majid and al. in 2023 in Iraq who found prevalences of hypovitaminosis D of 85% in infertile women (44). Similarly, Balci and al. 2019 also found 71.15% deficiency and insufficiency in their population in Turkey (45). Mogili and al. 2018 found also that Vitamin D deficiency was observed in 70.3% women, 20.3% were [vitamin D](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/vitamin-d) insufficient and only 9.4% were vitamin D sufficient (43). In the same vein, Triggianese and al. 2017 in Italy reported that infertile women presented lower vitamin D than non-infertile women (46).

Numerous studies highlight the involvement of socio-demographic factors such as sun exposure, dietary habits, socio-economic status and even body mass index (BMI) in the prevalence of hypovitaminosis D. Thus, comparing the profiles of infertile women in sunny regions; a study conducted in Egypt showed a prevalence of hypovitaminosis D in infertile women of 79% (47), while research in South Asia, an equally sunny region, reported a prevalence of up to 85%, largely due to the cultural use of covering clothing that limits exposure to the sun(48). In Europe, where there is less sunshine, studies also show high rates of hypovitaminosis D, particularly in winter. However, the situation there is generally better managed thanks to systematic vitamin D supplementation, especially in the Nordic countries (49).

In West Africa, a study by Soja and al. 2020, has shown that skin pigmentation, often associated with low vitamin D synthesis under UVB radiation, is a major contributor to vitamin D deficiency in urban areas (50). In addition, the sedentary lifestyle associated with urban living reduces exposure to sunlight, exacerbating vitamin D insufficiency (30).

**Implications of vitamin D for fertility**

Several studies confirm vitamin D’s role in biological processes crucial to fertility, including the production of sex hormones such as progesterone and estrogen, promoting oocyte maturation and increasing endometrial receptivity for successful embryo implantation (28,51). Thus, Irani and Merhi. 2014 demonstrated that vitamin D promotes oocyte maturation, improves embryo quality and participates in improving endometrial receptivity (52).

Although the data concerning vitamin D and fertility are not conclusive, a large number of studies have shown that vitamin D concentrations above 30 ng/ml were associated with higher pregnancy rates (14,28). In addition, pre-pregnancy vitamin D values above 30.05 ng/mL have been associated with a greater likelihood of pregnancy, fewer pregnancy losses and an increase in the number of live births (53,54), while very low vitamin D values have been associated with an increased risk of preterm delivery, gestational diabetes, pre-eclampsia (very high blood pressure during pregnancy) and bacterial vaginosis (51,54). Vitamin D deficiency and inadequate levels had a negative impact on the success of in vitro fertilization (IVF). Women with adequate levels had a higher probability of clinical pregnancy per initiated IVF cycle (52.5% versus 34.7%; p<0.001) than those with inadequate levels (34.7%) (55).

Several studies also highlight the importance of vitamin D for conception, placentation, the course of pregnancy and the well-being of the offspring. Hypovitaminosis D is associated with infertility and a number of adverse pregnancy outcomes (56,57)

Studies show that adequate vitamin D levels are associated with improved fertility treatment outcomes, including pregnancy rates after in vitro fertilization (IVF). In our study, only 18.63% of women had optimal vitamin D levels, highlighting a potential fertility defect and the need for preventive interventions.

**Implications for management**

All these findings suggest the need to maintain vitamin D concentrations at optimal levels that could have a positive impact on fertility. A proactive approach, including systematic screening for hypovitaminosis D, nutritional assessment and possible vitamin D supplementation, would be important elements to consider in the management of a couple's fertility.

Further research is needed to assess the effect of supplementation on fertility outcomes in this at-risk population**.**

**Conclusion**

Hypovitaminosis D (vitamin D deficiency or insufficiency) is defined as a low serum level of 25-hydroxyvitamin D [25(OH) VIT D]. The prevalence of hypovitaminosis D among infertile women in Abidjan is alarming. This finding is all the more worrying as vitamin D plays an essential role in reproductive health, suggesting that targeted interventions are needed to improve reproductive health and prevent the complications associated with hypovitaminosis D.

In this study we used a single socio-demographic factor, suggesting that other factors, such as nutritional, environmental or genetic influences, may play a great role in the prevalence of this hypovitaminosis D. These results underline the importance of comprehensive management including vitamin D supplementation in infertility treatment protocols in this population.

**Study limits**

It would have been interesting to work on a larger population. In addition, a case-control study would enable us to compare women with and without fertility problems, and to establish cause-and-effect relationships with factors taking into account data on sun exposure and diet in a cross-sectional study would enable us to generalize the study’s conclusions.

**Artificial intelligence disclaimer**

The authors hereby declare that no generative artificial intelligence technologies such as large language models (ChatGPT, COPILOT, etc.) and text-image generators were used during the writing or editing of this manuscript.

**Ethical approval**

The study was approved by the local ethics committee of the Ministry of Health. A free and informed consent form was obtained from all participants.

**Competing interests**

The authors declared that there were no conflicts of interest.

**Consent**

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

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