# Vitamin D plasma levels during summer in a psychiatric population are comparable to the winter levels of healthy individuals

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## ABSTRACT

**INTRODUCTION:** Our understanding of the influence of a low plasma-25(OH) vitamin $D_3$ (25-OHD) level on psychiatric disease is growing. Very limited information is available about the 25-OHD level in psychiatric populations. This study was initiated to determine which patients should have their 25-OHD levels analysed and who would require treatment.

**MATERIAL AND METHODS:** This retrospective, cross-sectional study comprised patients admitted for hospitalisation at Mental Health Centre Frederiksberg from 25 May to 9 September 2010. A total of 170 patients and their corresponding 25-OHD results were included.

**RESULTS:** Of the 170 patients, 55% (n = 93) were women and 45% (n = 77) were men. Thirteen patients (8%) had severe to moderate 25-OHD deficiency, 59 had insufficiency and 98 had a normal 25-OHD. In total, 42% of the results were abnormal. No differences were detected according to sex, age or diagnosis group. No correlation was found between 25-OHD and cobalamine, thyroid-stimulating hormone or $Ca^{2+}$.

**CONCLUSION:** It should be possible from the patient history, i.e. geographical or lifestyle issues, to identify patients at risk of 25-OHD deficiency or insufficiency, and only perform the 25-OHD test on these patients. A vitamin D supplement may be considered for all high-risk patients even without knowing their exact 25-OHD values. This would allow such patients to be treated as recommended (the Danish Health and Medicines Authority). The recommended treatment for "patients who do not get out and who avoid the sun" is a daily 10 µg vitamin D supplement. Some of the patients may preferably be treated as "nursing home residents" and thus be given a 20 µg vitamin D supplement and 800-1,000 mg calcium daily.


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**TRIAL REGISTRATION:** not relevant.

Our understanding of the influence of a low plasma-25(OH) vitamin $D_3$ (25-OHD) level on psychiatric diseases is growing. An increased risk of developing schizophrenia in children has been found if 25-OHD is low during pregnancy [1], and it has been found that a vitamin D supplement during the first post-natal year decreases the risk of schizophrenia [2]. Vitamin D deficiency is associated with low mood and impaired cognitive performance in older adults [3]. Among obese women, a vitamin D supplement has been found to decrease symptoms of depression [4]. As a consequence of a review paper published in April 2010 on the implication of low 25-OHD on neuropsychiatric conditions [5], it was decided to include 25-OHD analyses of the blood sampling as part of the routine in-patient admissions at the psychiatric ward at Mental Health Centre Frederiksberg (PCF). This centre has a catchment area of 133,206 people in the municipality and has a yearly in-patient admission of 1,050 (2010 data). The PCF has an open, intensive and geriatric ward and admits patients above 17 years of age. The admitted patients represent a mix of most psychiatric diagnoses.

Very limited information is available on the 25-OHD level in psychiatric populations. In order to determine which patients should have their 25-OHD levels analysed and who require treatment, this study was set up to investigate the following questions:

Sun exposure – summer and winter.

**ORIGINAL ARTICLE**

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– Are the 25-OHD levels of psychiatric patients at admission lower than those of the background population?
– Are the 25-OHD levels of patients with a mood (affective) disorder (International Classification of Diseases (ICD)-10: F30-39 diagnosis) lower than those of patients with other psychiatric diagnoses?
– Is there a difference in 25-OHD level between men and women or between age groups?
– Due to the cost of the analysis: Is it possible to establish a "marker" for the 25-OHD value if a correlation is found between 25-OHD and either $Ca^{2+}$, TSH or cobalamine – three other routine laboratory analyses?

## MATERIAL AND METHODS

This retrospective, cross-sectional study included patients admitted for hospitalisation at the PCF during the period from 25 May to 9 September 2010. The study included a total of 232 blood samples. The study was approved by the Danish Data Protection Agency and The Danish Health Authorities.

Plasma-25-OHD concentration was analysed using a validated electrochemiluminescence competitive immunoassay with a measurement interval of 25-250 nmol/l. (The method reported results as "< 25 nmol/l" for all results below 25 nmol/l).

According to the Danish health authorities, the 25-OHD concentration reference intervals are as follows:

Severe deficiency: < 12 nmol/l
Moderate deficiency: 12-25 nmol/l
Insufficiency: 25-50 nmol/l
Normal: > 50 nmol/l

Furthermore, patients were categorised into three ICD-10 diagnosis groups: F20-29, F30-39 and "others".

### Study population

The 232 blood samples included 61 re-admissions (a total of 45 patients were re-admitted 1-4 times in the study period). Only samples from the first admission were included, as it was assumed that patients would be treated with vitamin D in cases where results showed an abnormal value. One patient did not have a 25-OHD analysis performed at admission. The study population therefore consisted of 170 patients and their corresponding 25-OHD results from their first admission. No patients were treated with a prescribed vitamin D supplement prior to their first admission.

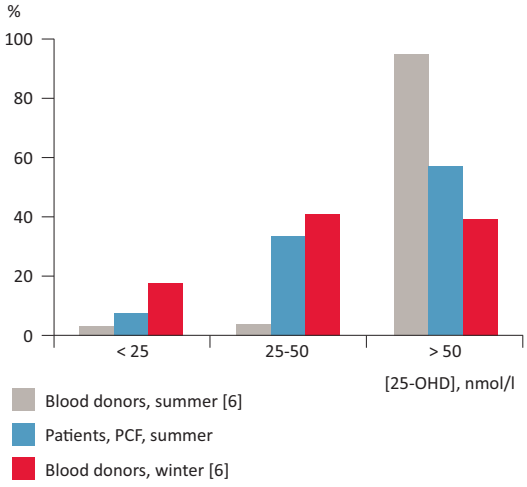
### Statistical analysis

Age and concentrations of 25-OHD, serum calcium, serum TSH and serum cobalamine were tested for normal distribution using the Shapiro-Wilk normality test. Only serum calcium data were normally distributed. The Kruskal-Wallis rank sum test was used to test for correlation. The $\chi^2$-test was used to test categorised data. 25-OHD data "< 25"were included in the analysis as "25" and serum cobalamine "> 1,480" as "1,480".

*Trial registration:* not relevant.

FIGURE 1

Concentration of plasma-25(OH) vitamin $D_3$ (25-OHD) in psychiatric patients compared with healthy blood donors.




PCF = Mental Health Centre Frederiksberg

## RESULTS

Of the 170 patients, 55% (n = 93) were women and 45% (n = 77) were men.

Thirteen patients (8%) had severe to moderate 25-OHD deficiency, 59 (34%) had insufficiency and values were normal in 98 (58%). In total, 42% of the results were abnormal.

There were no statistical differences between sexes, age or diagnose groups. An extended statistical analysis was carried out on the age (not categorised) and the corresponding 25-OHD value, and no statistical difference was found (p = 0.7). No correlation was found between 25-OHD and cobalamine, TSH or $Ca^{2+}$.

## DISCUSSION

In a review paper from 2005 [6], vitamin D status was presented for various Danish population groups. Among healthy blood donors, 0% had severe deficiency, 18% had moderate deficiency and 42% had insufficiency during winter time. In the summer period the corresponding shares were 0, 0 and 4%, respectively. For older people (66-88 years, living at home) the respective values – all year – were 12, 19 and 47%.

In this study it was found that 42% of all admitted patients had an abnormal 25-OHD level during a period of three summer months. This is a high frequency compared with the 4% found in blood donors (p = 0.0001, $\chi^2$ = 81.187) (**Figure 1**). The 25-OHD levels in psychiatric patients during summer are therefore comparable to those of healthy blood donors in winter time.

Recent studies [7, 8] support the findings that vitamin D deficiency is prevalent in an unselected in-patient psychiatric population. In a more selected group of psychiatric patients [9], it was shown that vitamin D levels were lower in patients with schizophrenia than in patients with depression and in healthy controls. Associations between depression and low vitamin D levels have been identified in a recently published clinical review article [10]. However, no studies have yet clarified whether vitamin D deficiency is an antecedent cause, a correlate or a consequence of depression. A randomised, prospective, controlled clinical trial is warranted to document any effect. Such a study is currently ongoing in Region South Denmark in patients with unipolar depression.

The 25-OHD analysis is costly (up to 400 DKK) and it should be possible to identify the patients at risk of 25-OHD deficiency or insufficiency from the patient history, i.e. geographical or lifestyle issues, and then only to perform the test on these patients. This procedure is also recommended by Parker & Brotchie [10]. A daily vitamin D supplement of 10 µg to all high-risk patients may be considered even without actually knowing their exact 25-OHD levels. This would allow these patients to be treated as recommended [11]. Some of these "patients who do not get out and who avoid the sun" may even preferably be treated as nursing home residents and be administered 20 µg of vitamin D and 800-1000 mg calcium daily. There seems to be no problems associated with administering up to 50 µg vitamin D daily, which is the upper tolerability dosage defined in the USA and the EU [12].

The full implication on disease/symptoms of abnormal 25-OHD is not yet known for psychiatric patients. Data representing the winter period are not available, and no recommended dose of vitamin D exists for this population. However, a general all-cause lowest mortality risk at a 25-OHD plasma level within the 50-60 nmol/l range was demonstrated in recent data from the CopD study – a retrospective, observational cohort study including 247,574 subjects from the general practice in Copenhagen [13].

## CONCLUSION

No evidence was found for measuring 25-OHD concentration in subgroups of patients related to sex, age or diagnosis group. A total of 42% of the patients admitted to the psychiatric ward during a summer period had an abnormal 25-OHD level. It should be possible from the patient history to identify the patients at risk of 25-OHD deficiency or insufficiency, and then to only perform the test on these patients. A daily vitamin D supplement of 10 µg given to all high-risk patients may be considered, even without actually knowing their exact 25-OHD levels. Furthermore, these patients should be treated as recommended by the Danish Health and Medicines Authority [11].

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**CONFLICTS OF INTEREST:** Disclosure forms provided by the authors are available with the full text of this article at www.danmedj.dk.

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