

THE EFFECT OF NARROWBAND ULTRAVIOLET B PHOTOTHERAPY ON LEVELS OF SERUM VITAMIN D3 IN PSORIATIC PATIENTS

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ABSTRACT

Background: Ultraviolet (UV) radiation is a well-established and effective treatment option in mild to moderate psoriasis. These clinical developments have encouraged conducting more studies on the mechanisms by which phototherapy work. The skill gained from this work is an indispensable prerequisite to make treatment decisions based on a rational rather than empirical decision. **Aim:** It is also known that radiation of wavelength between 295 and 315 nm is responsible for cutaneous vitamin D3 production. so that The goal of the present study is to investigate the effect of narrowband UVB (NB-UVB) phototherapy on serum 25-hydroxyvitamin D (25[OH]D) levels and related parameters in patients with psoriasis. **Methods:** A prospective study invol of a total of 25 participants with psoriasis requiring phototherapy thrice weekly for 6 weeks were enrolled in this study. Serum vitamin D levels were measured at baseline and at approximately 6 weeks into phototherapy. PASI was evaluated at baseline among patients and do it again after receiving 6 weeks of NBUVB therapy. Database were adjusted for, patients', sex, age, clinical type of psoriasis, the duration of psoriasis and Fitzpatrick skin phototype. **Results** A total of 25 patients presenting with psoriasis, the mean values of serum vitamin D3 level **before** treatment were 14.93 ± 1.9 and increased after treatment by 26.5%. The mean values of the serum level of vitamin D3 **after** phototherapy were 18.89 ± 4.8 (number of sessions = 18) with statistically significant differences before and after treatment although the values remaining within the range of inadequacy. The mean values of PASI **before** treatment were 17.46 ± 8.6 with a decrease in the mean values **after** treatment and became 11.69 ± 5.2 there was a significant improvement in PASI as well as 25(OH)D ($P < 0.05$) without a significant. **Conclusions:** Improvement in PASI and serum 25(OH)D levels after NBUVB in psoriasis is significant but weak and inconsistent relations with each other. Vitamin D may not be the distinct mediator of the therapeutic effects of NBUVB on psoriasis.

KEYWORDS: Psoriasis; Vitamin D; Phototherapy.

INTRODUCTION

Psoriasis is a genetically programmed pathologic interaction between skin cells, immunocytes, and numerous biological signaling molecules triggered by environmental stimuli. The immune response is a cellular one; TH1 and TH17 cells are activated by IL-12 and IL-23 secreted by antigen-presenting cells in the skin. Through various cytokines such as TNF alpha, these cells cause a chronic inflammatory state and alter epidermal hyperproliferation, differentiation, apoptosis,

and neoangiogenesis that produce the findings. seen in this disease.^[1,3]

Vitamin D continues to receive a great deal of attention It is a worldwide endemic and is associated with a wide variety of severe diseases, a role for vitamin D in the pathogenesis of different skin diseases, including psoriasis has been reported, Due to its role in proliferation and differentiation of keratinocytes, Regulation of cutaneous immune system down-

regulation of pro-inflammatory cytokines, Regulation of barrier integrity and permeability and therefor vitamin D analogs have become an important local therapeutic choice in the treatment of psoriasis.^[2]

Vitamin D is recognized as the sunshine vitamin because when the skin is exposed to sunlight, the action of the ultraviolet B (UVB = 290–315 nm) portion of sunlight causes the photolysis of 7-dehydrocholesterol to previtamin D. Once previtamin D₃ is formed in the skin, it is quickly transformed by the rearrangement of its double bonds (isomerization) into vitamin D₃ cholecalciferol. The liver converts cholecalciferol to calcidiol (which is the major circulating form of vitamin D that is used by clinicians to measure vitamin D status), which is then converted to calcitriol (which is the most biologically active chemical form of the vitamin metabolite) in the kidneys.^{[2][3][4]}

Although UV wavelengths between 290–300 nm were found to be the most efficient for vitamin D₃ production in humans, it is known that production stops below 260 nm and above 315 nm.^[3]

A variety of endogenous factors and environmental influences can alter the skin's production of vitamin D, including skin color, sunscreen use, clothing, latitude, season, hour, and aging.^[2]

And because of Phototherapy, which consists of ultraviolet irradiations delivered by fluorescent lamps. Narrowband UVB treatment with light sources that peak at 311 to 313 nm has been used with high efficacy and a low side-effects, plays an important role in the approach to the treatment of psoriasis and is well-established in today's armamentarium of dermatological therapy, and can lead to long-term remission therefor more clinical research has increased to understanding the mechanisms of action of phototherapy. And to increase the knowledge regarding vitamin D status in psoriasis patients during treatment with phototherapy.^[5,6]

MATERIALS AND METHODS

The study protocol was approved by the ethics committee of Tishreen University Hospital and all the subjects gave their informed consent to participate and were informed of the purpose of the study. A prospective study was conducted in the Department of Dermatology and Venereology of Tishreen University Hospital during the period 2022-2023. The Selection criteria for inclusion were:

Patient with psoriasis from the outpatient clinic who had not been treated with phototherapy in the previous 6 months.

The Exclusion criteria were as follows:

1. Pregnancy or lactation
2. Renal and liver disease
3. Treatment with topical vitamin D analogs in the previous 4 weeks

4. Known abnormalities of calcium metabolism
5. Drugs affecting calcium metabolism (anticonvulsants, barbiturates, vitamin D supplements, and corticosteroids)
6. Abnormal photosensitivity
7. Previous failure of or intolerance to phototherapy

Treatment protocol

25(OH)D levels were estimated by taking a 2 mL fasting morning blood sample using ichroma™ Vitamin D a fluorescence Immunoassay (FIA) for the quantitative determination of a total 25(OH) D₂/D₃ levels in human serum/plasma. Levels of 25-OH vitamin D₃ were graded as:

- Deficiency < 10 ng/mL
- Insufficiency 10-30 ng/mL
- Sufficiency 30-100 ng/mL
- Toxicity > 100 ng/mL

NBUVB phototherapy was given using Waldmann UV 1000 L (TL 01) cabinet was exposed, during treatment, genitals were shielded and eyes were protected with UV safety glasses.

Phototherapy was administered 3 times a week (Sunday, Tuesday, and Thursday) for 6 weeks

The NB UVB dose was increased with each treatment according to skin type by 0.05 J/cm² (for a maximum of 3 J/cm²).

Statistical analysis:

Data are given as mean ± SD or median min–max if not otherwise stated. Simple descriptive statistics and univariate correlations were performed using the statistics routines of software (Excel, Microsoft Inc, SPSS, and Version 20).

Student's paired t-test was used for comparisons of the blood test results before and after NB-UVB exposure. Associations between variables were tested by Pearson correlation analysis. One Way ANOVA to compare the averages of several independent groups. Probability values were considered significant at values of <0.05.

RESULTS

The research sample included 25 patients [64% males, and 36% females, Sex Ratio (M:F) = 1.7:1] of mild to severe psoriasis patients who attended the Dermatology Department at Tishreen University Hospital in Lattakia during the time period 2022-2023 and who fulfilled the inclusion criteria of the research. Aged between 5-61 years (mean 35.6±18.4 years). The maximum number of cases (32 % of the total) belonged to the age group >50 years and the least number of cases (8%) were recorded in the age group <10 years.

Duration of disease ranged between 1-30 years with a median of 5 years.

5 patients of psoriasis had a positive family history of the similar disease (20%).

Most of the Individuals with skin type (Fitzpatrick) III (44%) followed by (Fitzpatrick) II (32%) More than 84% of patients with psoriasis were classified as severe according to PASI index. And Plaque psoriasis was the most common type.

At onset the mean ± SD serum calcidiol concentration was 14.93 ±1.9 ng/mL in patients with PS range (11.35-20.40), all of them had vitamin D insufficiency (Insufficiency 10-30 ng/mL).

The NB-UVB course significantly (P < 0, 0001) increased serum calcidiol in PS After 18 NB-UVB exposures serum calcidiol increased by a mean of 18.89±4.8 Range (13.75-33.10).

All patients remained insufficient after treatment, except for one case only, which became sufficient as shown in Table (1)

We note that there are no statistically significant differences with regard to the average values of vitamin D3 between males and females, whether before treatment or after treatment. However, there was a rise in the values when comparing the values before treatment with the values after treatment, and the percentage of improvement was higher in males.

We observe that there are statistically significant differences with regard to the average values of vitamin D3 according to the age groups, whether before treatment or after treatment, with a rise in the values when comparing the values before treatment with the values after treatment in each group, and the percentage of improvement was higher in the age group less than 10 years old. Table (1)

Table 1

Age categories	Before treatment	After treatment	Improvement rate
<10	17.12 ± 4.6	26.27 ± 9.6	53.4%
10-20	14.45± 2.8	19.93 ± 5.03	37.9%
20-30	15.11± 1.8	17.24± 6.1	14.1%
30-40	14.75 ± 1.6	19.73 ± 5.3	33.8%
40-50	15.23 ± 1.1	16.23 ± 2.4	6.6%
>50	14.58 ± 0.5	17.60 ± 2.1	20.7%
P-value	0.04	0.02	

We register that there are no statistically significant differences with regard to the average values of vitamin D3 between skin types, whether before treatment or after treatment, but there was a rise in the values when comparing the values before treatment with the values after treatment, and the percentage of improvement was close between the three types.

We also take notes of that there are no statistically significant differences with regard to the average values of vitamin D3 and duration of disease, whether before treatment or after treatment, but there was a rise in the

values when comparing the values before treatment with the values after treatment, and the percentage of improvement was close.

The percentage of improvement was higher when the severity of psoriasis was mild and palmplanter and guttte psoriasis show more improvement than other type.

There are statistically significant differences with regard to the mean values of the serum level of vitamin D3, as there was a rise in the mean values after narrow-band UVB phototherapy, with an increase rate of 26.5%.

Table 2: Comparison of 25(OH)D level at baseline between psoriasis patients before and after treatment.

Parameters	Mean ± SD	Min-Max	P-value	Significance
At baseline	14.93 ±1.9	11.35-20.40	0.0001	S
after treatment	18.89±4.8	13.75-33.10		

Correlation between mean PASI and mean 25(OH)D was weak (r = 0.206) and was statistically insignificant (P = 0.284).

We mark from the table that there are statistically significant differences with regard to the average values

of the PASI improvement index, where there was a decrease in the average values after narrow-band UVB phototherapy, with a decrease of 33.04%.

Table 3: Comparison between mean improvement in PASI before and after 6 weeks of phototherapy among patients with psoriasis (n=25).

Parameters	Mean ± SD	Min-Max	P-value	Significance
At baseline	17.46±8.6	3.20-35.60	0.0001	S
after treatment	11.69±5.2	0-22		

We note by applying the Pearson Correlation coefficient that there are no statistically significant differences

between the values of vitamin D3 and the cumulative dose with a p-value <0.05.

	Pearson Correlation	P-value
Before treatment	0.1	0.5
After treatment	0.2	0.7

DISCUSSION

Although there is markedly improvement in the serum level of 25(OH) D, we found that baseline serum level of 25(OH)D was low in both patients before and after 6 weeks of treatment with NBUVB, This is maybe due to the short duration of therapy.

Such therapy leads to enhanced cutaneous vitamin D synthesis, which may be one of the mechanisms of action but not the specific one.

Vitamin D insufficiency was found to be associated with psoriasis patients, independently of gender, skin type, duration of disease, and severity of disease.

We also notice that children <10 years show noticeably enhancement in serum level of 25(OH)D after therapy, Our study showed that the rate of improvement in vitamin D3 values was higher in the age group less than 10 years, as it is noted that there is an age-related decrease in the amount of 7-dehydrocholesterol in the dermis of the skin, as well as photoactivation and directly related to the intensity of exposure to sunlight, as children in this Age tend to stay outside to play with their peers, and for the same previous reasons, we see that the improvement was noticeable in the dotted pattern, being the most common in this age group.

A significant improvement in PASI was noted after therapy with NB-UVB although week correlation between vitamin D values with the improvement of the PASI index.

Very few studies have been done on psoriasis patients to assess the effect of NBUVB on 25(OH)D serum levels and severity of psoriasis. The findings of these studies corroborated with our study showing that NBUVB increases 25(OH)D levels in psoriasis patients and decreases severity of psoriasis But poorly correlation with each other.

The important result is that the dose–response curves are not linear; increasing the UV dose does not produce a corresponding increase in cholecalciferol concentration.

There was no significant correlation between cumulative dose of NBUVB phototherapy and change in 25(OH)D level in our study.

This nonlinear dose–response relationship may be due to the reciprocity law of cholecalciferol synthesis: firstly, higher UV doses cause previtamin D3 to be photoisomerised into tachysterol and lumisterol, reducing the previtamin D3 available to produce cholecalciferol; secondly, the reaction of previtamin D3 to 7-DHC is photoreversible, so previtamin D3 can convert back into 7-DHC with additional UV exposure; thirdly, once formed by thermal isomerization, cholecalciferol can itself be photodegraded to suprasterol I, suprasterol II and 5, 6-transvitamin D3.

CONCLUSION

Our current study shows the effectiveness of ultraviolet light phototherapy in treating patients with psoriasis, and despite its statistically significant and clinically modest effectiveness in raising serum levels of vitamin D3, it is important to confirm that the maximum effectiveness of ultraviolet light, which is able to raise serum levels of vitamin D3 ideally, is located Within the wavelength range 290-300 nm, therefore, the wavelength 311-313nm is modestly able to raise the values of vitamin D. We also did not find a relationship between the cumulative dose of ultraviolet radiation and the values of vitamin D despite its efficiency in improving the PASI index in patients with psoriasis, which is done through other molecular mechanisms and the reason It is due to the non-linearity in the formation of vitamin D. Thus, excessive doses of ultraviolet radiation do not cause an increase in serum levels of vitamin D3, but rather expose the patient to its dangerous carcinogenic effects as well

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