

Exploring The Influence Of Vitamin D In The Management Of Acne Vulgaris: A Pilot Study

Aqsa Naheed¹, Aashi Mughal², Tehzeeb Zehra³, Rahila Aamir⁴, Samina Fida⁵, Taha Naveed⁶

Abstract

Objective: The study aimed to explore the potential benefits of vitamin D supplementation in improving acne severity.

Methods: This pilot study was carried out at HIT Hospital, Taxila. The study included nine female patients aged between 12 and 30 years, with acne vulgaris and having deficient serum 25-hydroxyvitamin D3 (25(OH)D) levels (<30 nmol/L). Exclusion criteria included the use of topical or oral treatments for acne, including retinoids, as well as those with a history of multivitamin or systemic steroid intake, and patients with any chronic disease. Global Acne Grading (GAG) score was used to assess the severity of acne vulgaris. Patients received a daily dosage of 1000 IU of vitamin D drops per day for 2 months so that vitamin D deficiency is corrected. After 2 months, the GAG score was re-calculated and documented. Data analysis was performed using SPSS version 28.

Results: The mean age of the study participants was 18.33 years (SD= 3.3 Years). A statistically insignificant association ($p=0.49$) and weak positive correlation ($r= 0.17$, $p=0.65$) were observed between Vit D levels and acne Status and GAG-1 score on applying chi-square test and Pearson correlation respectively. A paired-sample t-test showed a significant difference in the GAG-1 Score (Mean=25.44, SD=7.6) and GAG-2 Score (M=15.1, SD=4.5) after Vit D supplementation. $t(5.3)$, ($p= 0.001$).

Conclusion: The results suggest that correcting vitamin D deficiency through supplementation resulted in a significant improvement in acne severity.

Keywords: Acne vulgaris, Vitamin D, GAG score

¹ Professor, Department of Dermatology, HITC-IMS, Taxila; ² Professor, Community Medicine, HITEC-IMS, Taxila; ^{3,4} Assistant Professor, Department of Medicine, Shifa Tameer-E-Millat University; ⁵ Professor of Medicine, Akhtar Saeed Medical College, Lahore; ⁶ House Officer, HITEC-IMS, Taxila.

Correspondence: Dr. Aqsa Naheed, Professor of Dermatology, Heavy Industry Taxila Education City Institute of Medical Sciences, Taxila. **Email:** aqsanahid@gmail.com

Cite this Article: Naheed A, Mughal A, Zehra T, Aamir R, Fida S, Naveed T. Exploring The Influence Of Vitamin D In The Management Of Acne Vulgaris: A Pilot Study. JRMC. 2023 Dec. 30;27(4): 646 - 650. <https://doi.org/10.37939/jrmc.v27i4.2364>.

Received August 07, 2023; accepted November 20, 2023; published online December 30, 2023

1. Introduction

Vitamin D, a fat-soluble prohormone steroid, possesses distinct endocrine, paracrine, and autocrine functions.¹ Its endocrine effects primarily involve regulating serum calcium homeostasis. The paracrine and autocrine effects of vitamin D encompass various outcomes, such as inhibiting cell proliferation, promoting cell differentiation, and triggering apoptosis. These mechanisms are believed to have significant implications in areas such as cancer, immunity, and multiple organ systems.^{2,3}

The skin possesses a unique characteristic of not only producing vitamin D for the body but also responding to exogenous vitamin D (1,25(OH)2D) supplementation. Both vitamin D and the vitamin D receptor (VDR) play pivotal roles in skin physiology. Calcium and vitamin D3 have intertwined functions in the process of skin differentiation like keratinocyte envelope formation, promote differentiation, and inhibit proliferation.⁴ Additionally, they contribute to the innate immune response by inducing toll-like receptor 2 (TLR2) and its coreceptor CD14. The

synthesis and metabolism of vitamin D are also known to have an impact on regulating growth and cellular functions in sebaceous glands.⁴

Considering the interplay between vitamin D and the skin, it is reasonable to implicate vitamin D deficiency in a wide range of dermatological conditions. However, it remains speculative whether vitamin D deficiency plays a primary role in the pathogenesis of these diseases or if it is merely a consequence of the underlying inflammatory processes.^{5,6}

Acne, a chronic condition affecting the pilosebaceous unit, presents significant challenges in dermatology due to its complex clinical nature and diverse patient needs. It is one of the most prevalent skin disorders among individuals aged 15 to 40 years. The exact cause of acne is still unknown, but research indicates the involvement of multiple factors. Four main processes contribute to its development: the presence of *Propionibacterium acnes* (*P. acnes*), keratinocyte hyperproliferation, androgen-mediated increase in sebum production, and inflammation.^{7,8}

P. acnes, a normal bacterial flora found in the follicular unit, may play a role in stimulating

proinflammatory cytokines and immune responses. Furthermore, disrupted follicular keratinization and changes in sebum production, composition, and oxidant-to-antioxidant ratios are observed in acne formation.⁹ Understanding the intricate mechanisms involved in acne pathogenesis, it has been determined that the local synthesis or metabolism of vitamin D metabolites may have important implications for growth regulation and various cellular functions within sebaceous glands. This suggests that sebaceous glands hold promise as potential targets for therapeutic interventions involving vitamin D supplements.⁵ Considering the potential role of vitamin D in skin health and the pathogenesis of acne, we designed this pilot study to assess the effect of correcting vitamin D deficiency on the severity of acne vulgaris. To the best of our knowledge, no such study has been conducted in Pakistan, highlighting the need to explore this aspect in our local population.

2. Materials & Methods

This pilot study was carried out at HIT Hospital, Taxila, from January 23 to June 23. The study included nine female patients through purposive sampling who sought treatment at the hospital's Dermatology OPD. Ethical clearance was obtained from the IRB. The study encompassed unmarried female participants, aged between 12 and 30 years with acne vulgaris and exhibited deficient serum 25-hydroxyvitamin D₃ (25(OH)D) levels, specifically less than 30 nmol/L. Patients who had actively used any form of topical, oral, or other treatments for acne, including retinoids, within six months before the study, as well as those with a history of multivitamin or systemic steroid intake, and patients with any chronic disease, were excluded from the study.

The patients were thoroughly briefed about the study and written consent was taken. Pertinent demographic data, encompassing age, duration of disease, and previous family history of acne, were recorded using a standardized form. The patients underwent evaluations by dermatologists, Global Acne Grading (GAG) score⁽¹⁰⁾ was used to assess the severity of acne vulgaris for each participant. The GAG score categorizes acne as follows: 0 (None), 1-18 (Mild), 19-30 (Moderate), 31-38 (Severe), and > 39 (Very severe). The determination of serum 25(OH)D levels was carried out using the Elecsys and Cobas e analyzer, manufactured by Roche

Diagnostics System in Switzerland. The levels of 25(OH)D⁽¹¹⁾ were classified into three categories: adequate (≥ 75 nmol/L), inadequate (30-75 nmol/L), and deficient (≤ 30 nmol/L). The subjects received a daily dosage of 1000 IU of vitamin D drops per day for 2 months so that vitamin D deficiency was corrected. Additionally, the participants were strictly instructed to abstain from using any topical acne creams or traditional home remedies. After 2 months, follow-up assessments were done, during which the participants' GAG score was re-calculated and documented.

Data analysis was performed using SPSS version 28. The chi-square test and Pearson correlation were used to assess the association between vitamin D levels and acne status, a P-value of < 0.05 was adopted as the threshold for statistical significance. The paired t-test was utilized to evaluate the disparity in GAG scores between the patients' pre and post-supplementation with vitamin D.

3. Results

This pilot study was conducted on 9 participants. The mean age of the study participants was 18.33 years (SD= 3.3 Years). Out of a total of 9 participants, 8 (88.9%) were students and one participant was employed. None of the study participants was using sunblock for the prevention of skin damage. Four participants (44.4%) had a positive family history of acne, whereas the family history of acne was negative among the remaining 5 (55.6%) participants. The mean BMI of study participants was 20.17 (SD= 3.7). Normal BMI (18.5-24.9) was recorded among 5 (55.6%), 3 participants were under-weight (<18.5) and only one participant was overweight (25-29.9). On presentation, the GAG score to categorize acne of the participants was mild (1-18) among 2 (22.2%) participants, moderate (19-30) among 4 (44.4%), and severe (31-38) among 3 (33.3%) participants. The mean GAG score at presentation (GAG-1) was 25.44 (SD=7.6). The mean Vit D level of the study participants was 26.5nmol/L (SD=5.6). Out of a total of 9 participants, 8 (88.9%) had deficient Vit D levels (≤ 30 nmol/L) and one participant (11.1%) had inadequate Vit D levels (30-75nmol/L). Acne was observed among 8 (88.8%) participants having deficient Vit D levels. Among these, 33.3% (n=3) had moderate and severe acne based on GAG Score respectively and 22.2% (n=2) had mild acne. However, a statistically insignificant association ($p=.49$) and weak positive correlation ($r= 0.17$, $p=0.65$) were observed between Vit D levels and acne Status and GAG-1 score on applying the chi-square test and Pearson correlation respectively.

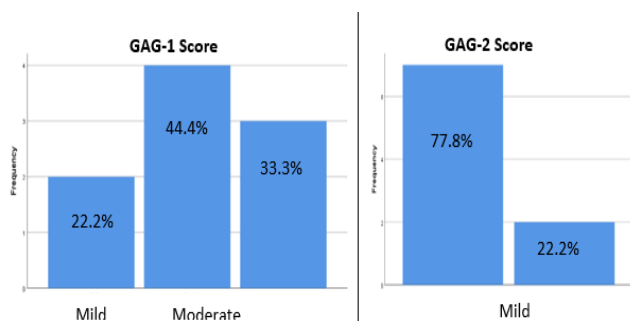


Figure 1: Comparison of Acne on GAG Score at presentation (GAG-1 score) and after Vit D supplementation (GAG-2 score)

The mean GAG-2 Score after Vit D supplementation was 15.1 (SD= 4.5). Mild acne was observed among 77.8% (n=7) participants and only 22.2% (n=2) participants had moderate acne. A paired-sample t-test was conducted to compare the GAG Score before and after Vit D supplementation among study participants. There was a significant difference in GAG-1 Score (Mean=25.44, SD=7.6) and GAG-2 Score (M=15.1, SD=4.5) after Vit D supplementation. $t(5.3), (p=0.001)$.

Table 1: Cross-tabulation of Vit D levels and Acne Status (GAG-1 SCORE)

Vit D levels	Acne Status (GAG-1 SCORE)			Total
	Mild	Moderate	Severe	
Deficient	2(22.2%)	3(33.3%)	3(33.3%)	8
Inadequate	0	1(11.1%)	0	1
Total	2(22.2%)	4(44.4%)	3(33.3%)	9

4. Discussion

The results of this pilot study showed that 8 (88.8%) participants having acne had deficient Vit D levels. Out of these Vit D deficient participants, 33.3% (n=3) had moderate and severe acne and 22.2% (n=2) had mild acne based on GAG Score respectively. A statistically significant difference (.001) in the GAG-1 Score and GAG-2 Score was observed after Vit D supplementation. However very weak positive ($r=.01$) statistically insignificant correlation was observed between the severity of Acne and Vit D levels. Our findings are consistent with the results of a study carried out by Iqbal T in Pakistan, that showed lower Vit D levels among individuals with acne vulgaris ($p<.001$) as compared to healthy controls. However, no correlation was reported between vitamin D levels and the severity

of acne vulgaris. The mean age of participants of our study was 18.3 years ($SD\pm 3.3$ years), in contrast to the high mean age (27.7 ± 7.4 years) of study participants reported by Iqbal T including both genders.¹²

Results of the present study are also comparable with findings reported by El-Tahlawi SM from Egypt, including 60 patients of acne with a mean age of 20.12 ± 2.04 years. The mean serum Vit D levels reported was 28.7 ± 10.65 . Deficient Vit D levels were observed among 45% (n=27) acne cases and 41.7% (n=25) had insufficient Vit D levels that were significantly ($p=.009$) lower than the control group. A statistically significant association was observed between the level of vitamin D deficiency and the severity of acne vulgaris ($p=0.023$). In our study, the mean Vit D level was 26.5nmol/L ($SD=5.6$) and 88.9% (n=8) had deficient Vit D levels. Contradictorily, a statistically insignificant association was observed between vitamin D and acne severity in our study. This discrepancy might have resulted due to a reduced sample size in the present study. El-Tahlawi SM suggested a possible role for vitamin D supplementation in acne treatment that is significantly observed in reducing the severity of acne in the present study.¹³

Goodarzi A from Iran reported that Vit D is pertinent to acne D, however, it is not associated with the severity of acne. Inconsistent with the results of our study, Goodarzi A describes high mean Vit D levels (29.30 ± 16.21) among acne cases as compared to controls (20.39 ± 14.89) of the same study. Contrary to our study that showed an insignificant weak positive association between Vit D levels and Acne score, Goodarzi A reported an inverse correlation between the acne severity and serum levels of vitamin D.¹⁴ Puspita F from Medan reported a significantly strong negative correlation between serum vit D levels with severity of Acne Vulgaris ($p < 0.05, r = -0.719$).¹⁵ However, the effect of vitamin D supplementation in the reduction of acne severity was not evaluated in either of these studies. To obtain more definite results and to explain this disparity, it is required to adopt a more comprehensive matched or interventional study with a larger sample size that is deficient in the present pilot study.

Aktaş Karabay E from Turkey conducted a cross-sectional study in which 65 cases had acne vulgaris, and 41 were healthy subjects. Severe acne was reported among 66.2% (n=43) patients, 21.5% (n=14) had moderate and 12.3% (n=8) had mild acne. Vit D deficiency was noted both among cases and healthy individuals. The mean serum Vit D level among acne

cases and healthy individuals was 10.22 ± 6.11 and 10.37 ± 7.41 respectively and was statistically insignificant ($p=0.692$; $p>0.05$). Complimenting the findings of our study, Aktaş Karabay E, also reported no correlation between Vit D levels and severity of acne vulgaris.¹⁶ Response to Vit D supplementation among acne patients despite of insignificant association between Vit D levels and acne severity in our study could be precisely interpreted by investigating the status of Vit D levels in acne cases and health controls in large-size studies. Toossi P from Iran also reported insignificant differences in vitamin D levels among acne cases and healthy controls. The mean GAG score of acne cases reported by Toossi P was 24.92 ± 10.57 , a bit lower than the GAG- 1 score observed in our study (25.44 ± 7.6), which might be attributed to the age difference of study population in the two studies. However, no significant difference was observed between Vit D levels among cases and controls nor any significant association was observed between acne severity and Vit D deficiency (<10 ng/mL) (OR=1.6; 95% CI: 0.65-3.91; $p=0.30$).¹⁷

The results of another study conducted by Kemeriz F are comparable with the findings of the present study. A statistically significant ($p=.0001$) difference in Serum Vit D levels was reported between acne cases (14.17 ± 7.42) and healthy controls (20.27 ± 3.17). Vit D deficiency and insufficiency were observed among 77.6% ($n=104$) and 20.9% ($n=28$) acne cases, while only 1.5% ($n=2$) cases had sufficient Vit D levels. The same study also reported that all 43 patients (100%) having very severe acne had severe Vit D deficiency whereas out of 64 Severe acne cases 93.8% ($n=60$) had severe Vit D deficiency. Kemeriz F also reported a negative-strong statistically significant correlation between GAGS scores and serum Vitamin D levels in patients with acne vulgaris ($P < .001$; $r = -.910$),¹⁸ which contradicts the weak positive correlation ($r=.17$, $p=.65$) between serum Vit D level and GAG score observed in our study. This contradiction is likely to be attributed to the small sample size in the present pilot study. However, the positive response to Vit D supplementation in acne cases in the present study supports the negative correlation between serum Vit D level and GAG score reported by Kemeriz F from Turkey.

Further research with larger sample sizes, randomized controlled designs, and longer intervention durations is needed to better understand the relationship between vitamin D and acne and to explore the potential

therapeutic benefits of vitamin D supplementation in acne management.

5. Conclusion

The results suggest that a significant proportion of participants with acne had deficient vitamin D levels. Moreover, correcting vitamin D deficiency through supplementation resulted in a significant improvement in acne severity, as assessed by the GAG score. However, this pilot study contributes to the growing interest in vitamin D's role in skin health and paves the way for more comprehensive investigations in this field.

CONFLICTS OF INTEREST- None

Financial support: None to report.

Potential competing interests: None to report

Contributions:

A.N - Conception of study

A.N, T.N - Experimentation/Study Conduction

A.M - Analysis/Interpretation/Discussion

A.N, A.M, T.Z - Manuscript Writing

T.Z, R.A, S.F - Critical Review

R.A - Facilitation and Material analysis

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