

Association between Serum 25-Hydroxyvitamin D Levels and Severity of Disease Among Iraqi Patients with Psoriasis A Hospital-Based Case-Control Study

Mustafa Abdulkareem Alhameedi^{1*}, Wejdan Abdulabbas Ibrahim Aljanaby²

ABSTRACT

Psoriasis is a chronic disease causes long life burden on the affected patients. Severe disease form associated with worsening of patient's health and most aspect of their life. Therefore, maintaining patients at less severe or minimal to mild disease can improve their quality of life and mental health. Vitamin D deficiency is currently representing pandemic all over the world, and so many studies conducted to correlate the Vitamin D level with different diseases including psoriasis and proved the association between lower Vitamin D levels and more severe form of the disease. Our objective to assess the association between Vitamin D levels and the severity of psoriasis based on the Psoriasis Area and Severity Index (PASI). We conducted a case-control study during a period of 16 months at Al-Najaf Teaching Hospital included 100 psoriasis patients and 100 apparently health controls who met the inclusion criteria. Our findings showed higher frequency of Vitamin D deficiency in psoriasis patients compared to controls. Vitamin D levels were lower in psoriasis patients in all aspect of severity (mild, moderate and severe) compared to healthy controls.

A significant inverse correlation was found between Vitamin D level and PASI score in psoriasis patients and vitamin D was a strong predictor of severe psoriasis with high sensitivity, specificity and accuracy of more than 90%. We recommend routine assessment of vitamin D status in psoriasis patients particularly those with moderate to severe disease form also, we recommend conducting multicenter studies with larger sample size for more evaluation, comparison and precise conclusions

Keywords: Psoriasis, Severity, PASI, Vitamin D, Iraqi patients

Authors' Information

1.M.B.Ch.B, C.A.B.D.V, F.I.C.M.S Dermatology, Al-Najaf Teaching Hospital, Najaf Health Directorate, Najaf-Iraq

*corresponding author: derma.mustafa@gmail.com:

2. M.B.Ch.B, C.A.B.D.V, F.I.C.M.S Dermatology, Al-Najaf Teaching Hospital, Najaf Health Directorate, Najaf-Iraq

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INTRODUCTION:

Psoriasis is a chronic inflammatory disease and one of the common chronic dermatological pathologies, it occupies one of the leading places and impacting almost 2-3% of the global population. The prevalence of psoriasis, according to various literature sources, among the world's population ranges from 0.1% to 7% . The prevalence of psoriasis is almost 4.4% globally; however, its prevalence varies internationally; In Europe it was estimated at 4.6% while in Asia it was 5.7%. The previous studies on the prevalence of psoriasis reported inconsistent rates with wide variation ranged between 0.1% to 10% according to the region and population [1,2]. In Iraq, recent Master's thesis reported that the prevalence of psoriasis among Iraqi population is almost 2.3% [3].

The etiology of psoriasis is unknown, but several factors may contribute to its development; among these factors include genetic predisposition, extrinsic risk factors such as mechanical stress, air pollution, certain drugs, vaccination, infection, smoking and alcohol consumption. Intrinsic risk factors such as metabolic syndrome, obesity, diabetes mellitus, hypertension, and psychological / mental stress, furthermore, weather can play a significant role in worsening or improving the symptoms, for instance cold dry weather can worsen the symptoms while controlled exposure to sunlight, UV light, may improve symptoms in many patients which explain the seasonal variation in the course of disease . However, these factors can trigger or exacerbate the onset of psoriasis [4,5].

The pathogenesis of psoriasis, is not well recognized and the mechanisms leading to the development of psoriasis remain poorly understood. Currently, the leading role in the pathogenesis of the psoriatic process is assigned to the immune theory, As a study participants of the innate immune system, keratinocytes is well established as an essential in both initiation of development of psoriasis and the maintenance phase of the disease where keratinocytes act as trigger of psoriatic inflammation [6].

The disease severity is often based on clinical evaluation and the affected body areas. There are different tools used to assess the severity of psoriasis such as body surface area (BSA) percentage, the Dermatology Life Quality Index (DLQI), Physician's Global Assessment (PGA), specified tools like Nail Psoriasis Severity Index (NAPSI) , Psoriasis Scalp Severity Index (PSSI) ,

Psoriasis Symptom Inventory (PSI) and the most popular the Psoriasis Area and Severity Index (PASI), which is established by dermatologist as a gold standard clinical scale [7–10].

Despite the close attention to developing new treatment and prevention methods, psoriasis remains a pressing dermatological problem and its treatment still represents a pressing challenge. Psoriasis treatment methods used both in outpatient practice and in dermatology wards are varied and often unsubstantiated. However, optimization of therapy particularly for severe, widespread forms of psoriasis is a crucial issue among dermatologists [11].

In recent years, the role of vitamin D in different diseases has attracted a considerable interest within the scientific community. Vitamin D is a fat-soluble vitamin that plays an important role in regulating the immune system and maintaining bone health. In the years between 2000-2022, the prevalence of vitamin D deficiency in the general population was 15.7% [12]. Recent estimates in 2026, indicated that vitamin D deficiency affect almost half of the global population representing a worldwide public health challenge that required strategic action and intervention like food fortification and targeted supplementation [13]. In the Eastern Mediterranean region the prevalence reaches up to 80%, however, the prevalence of vitamin D deficiency varies depending on the cutoff values used to define deficient level, as well as latitude, the population studied, sex, age, and income level. There are several factors contribute to vitamin D deficiency or insufficiency, such as urbanization, less exposure to sun light, overweight/obesity, sedentary lifestyle and low physical activity, poor nutrition and unhealthy diet, smoking and using some therapeutic agents among the main factors in addition to non-modifiable factors such as age, sex and ethnicity [12]. Currently, it is well-known that the deficiency of vitamin D is linked to many chronic illnesses including psoriasis where the vitamin D deficiency was found to be significantly lower in psoriatic patients when compared to healthy controls [14,15].

However, data regarding the correlation between vitamin D status and PASI-defined severity of psoriasis among Iraqi patients has not been adequately documented. Therefore, the present study aimed to assess serum vitamin D levels in psoriatic patients in comparison to healthy controls, evaluate the correlation between serum vitamin D levels and disease severity as well as to identify the validity of vitamin D as a biomarker predicting the severe disease, we believe that the findings of our study can help implement a proper management plan and

monitoring of the course of disease via regular assessment of vitamin D levels in these patients.

PATIENTS AND METHODS:

A case-control clinical study was conducted over 16-month period at Al-Najaf city, in the middle of Iraq, between January 2025 and May 2026. The study included 200 adult Iraqi individuals assigned into two groups, Psoriasis group included 100 patients with psoriasis and control group composed of 100 healthy individuals attending the outpatient clinics

The enrolled patients presented with proved diagnosed psoriasis since at least 3 years. The control individuals selected from the clients of the dermatology outpatient clinic who were seeking routine check-up for non-inflammatory skin diseases and they were not having any disease at time of inclusion as well those who were relative and accompanied the patients in their visits

Sample size and sampling technique:

The sample size was calculated using the standard equation for sample size formula for comparing two independent means (as we measured serum vitamin D as scale variable)

$$N = k (\text{Var1} + \text{Var2}) / (M1 - M2)^2 \dots\dots\dots [k = (Z\alpha + Z\beta)^2]$$

Where N is the required sample size for each group, M1-M2, expected difference in mean serum vitamin D level between cases and controls. Var1, Var2 are Variance for group 1 and 2, $Z\alpha$ is the critical values for significance level of 5% which is = 1.96.

$Z\beta$, is the critical z value for the statistical power of 80%, it is = 0.84

The calculated sample size according to the equation was 42 per each group, however, we increase the sample size to 100 per group to enhance the statistical power, robust stratification of subgroups, according to vitamin D status and severity grading (PASI thresholds), as well as, ensuring the validity of Receiver operating characteristic curve analysis and to compensate any dropout, incomplete records and insufficient laboratory results due to biological specimens are do not meet laboratory requirements for testing [16].

Inclusion criteria

Psoriasis Patients

1. Iraqi adult patients with a confirmed diagnosis of chronic psoriasis through clinical history an/or medical files for at least 3 years before enrollment in the study.
2. Both genders sexes.
3. Diagnosed according to the clinical dermatological guidelines and clinical practice.
4. Agreed to participate in the study and performing the required investigations

Control group:

1. Iraqi adults of both genders and almost matched the demographic characteristics of psoriasis patients.
2. Have no clinical evidence of autoimmune, chronic inflammatory or skin diseases, with no history of psoriasis or psoriatic arthritis
3. Have no systemic inflammatory disorder, acute infection or metabolic/malabsorption disorders that may affect the serum vitamin D levels

Exclusion criteria:

1. History of chronic metabolic or systemic diseases like kidney diseases, liver disease and malignancies
2. Psoriatic patients using cytotoxic or biological agents
3. Having co-existing inflammatory skin disease
4. Known cases of vitamin D metabolism disorders or malabsorption syndrome
5. Pregnant and lactating women
6. Using vitamin D supplementation within the last three months
7. Having primary immunodeficiency or systemic autoimmune disease.
8. Using some medications like anticonvulsants or other medications that interfere with Vitamin D metabolism
9. Using topical treatment containing Vitamin D

Psoriasis severity assessment:

The severity of psoriasis among cases was assessed according to widely applied index, the Psoriasis Area and Severity Index (PASI). It is the primary clinical tool to assess the extent and severity of psoriasis. It is a cumulative scoring system assessing the lesion severity (erythema,

induration and desquamation) and the extent (percentage) of the affected body area; head, trunk, upper limbs and lower limbs. The clinical signs scored on f-point scale (0-4). The extent of affected area measured as percentage from 0% to 100% and scored on 0–6-point scale, 0% non-involved, 1 point for affected are of < 9%, 2 points for 10%-29% involvement, 3 for 30%-49%, 4 for 50%-69%, 5 for 70%-89%, and 6 points for 90%-100% involvement. The overall total score ranged between 0-72 points, with higher score indicate more severity. However, the thresholds of score indicated the severity grades are: < 10 PASI score for mild, 10-19 moderate and ≥ 20 PASI score for severe psoriasis. Online PASI calculator (version 1.7.3) [17] used in calculating the PASI score .

Vitamin D measurement and categorization

A sample of venous blood was collected from each participant and send to the laboratory for vitamin D level test as well as other requested investigations. Vitamin D was measured using standard laboratory procedures and protocols followed at our setting laboratory based on the Kit's manufacturer instructions that available in the leaflet attached with the testing kit. The measurement was done using the electrochemiluminescence immunoassay by an autoanalyzer. Vitamin D level was categorized according to the literature most commonly used classification as: Deficient (<20 ng/mL), Insufficient (20-29.9 ng/mL) and Sufficient (≥ 30 ng/mL) [18].

Ethical considerations.

In accordance with the Declaration of Helsinki of the World Medical Association on Ethical Principles for Medical Research Involving Human Subjects, in its 2013 revision, as well as good practices in clinical research and Ethical Aspects of research in human beings. This study did not represent any risk to the health of the participants because it used the routine methods that applied to all patients regardless their inclusion in the study with the collection of 5 ml of whole blood on only one occasion. Participation was voluntary. In this case, the patient agreed a verbal informed consent and received a clear instructions and information about the study and its objectives with the freedom to withdraw at any time without coercion or detriment to medical care.

Data management and analysis

Data were collected using a preconstructed data collection form, transformed into computerized database and analyzed using the statistical package for social sciences software version 29. Statistical tests were applied accordingly. Chi square test used to compare categorical variables, Student t test for two independent groups used to compare mean Vitamin D and mean PASI score between two subgroups, Analysis of variances (ANPVA) used to compare mean Vitamin D and PASI score for more than two subgroups. Receiver operating characteristic (ROC) curve analysis used to assess the performance of vitamin D as predictor of psoriasis severity. Regression analysis used to assess the validity of vitamin D as independent predictor for PASI-defined severity. Level of significance, set at ≤ 0.05 .

RESULTS:

In this case control clinical study, 100 patients with psoriasis and 100 healthy controls were enrolled, they were almost matched for their age and gender, (P. value >0.05 , not significant), The mean body mass index (BMI) and frequency of obesity were significantly higher in psoriasis group compared to control, the mean BMI was $27. \pm 4.9 \text{ kg/m}^2$ and $25.4 \pm 3.8 \text{ kg/m}^2$, respectively. Obesity was found in 27% of psoriasis group and 12% of controls, in both comparison (P. value <0.05 , significant), (**Table 1**). Comparison of vitamin D levels between groups revealed the vitamin D deficiency was significantly more frequent in psoriasis patients compared to control where 46% of psoriasis patients had deficient Vitamin D, 31% had insufficient and 23% had sufficient Vitamin D levels, in control group, 24% had deficient, 35% insufficient and 41% had sufficient Vitamin D levels, (P. value <0.05 , significant), (**Table 2**). So as when the mean Vitamin D level compared between groups, it was significantly lower in psoriasis patients than that in controls, 19.6 vs. 24.2 ng/ml, respectively, (P. value <0.05 , significant), (**Figure 1**). In psoriasis patients, the distribution of PASI-based severity of disease revealed that 21% had mild (PASI <10), 44% moderate (PASI 10-20) and 35% had severe disease (PASI >20), (**Table 3**). On the other hand the mean PASI of the total psoriasis patients was 15.6 ± 9.7 with a median of 14.5 and range (6-35). With regard to the comparison of mean Vitamin D across the PASI -based severity of psoriasis, it had been significantly found that Vitamin D was lowered with the increased severity, the mean Vitamin D was 27.1 ng/ml in mild cases,

21.6 ng/ml in moderate and 13.4 ng/ml in cases with severe psoriasis, P. value was highly significant <0.001, (**Table 4 & Figure 2**). From other point of view, we assess the correlation between PASI score and vitamin D from other direction where the PASI score compared across the Vitamin D status, deficiency, insufficiency and sufficiency, the mean total PASI score was significantly higher in psoriasis patients with deficient Vitamin D compared to those with insufficient and sufficient Vitamin D levels, the PASI score was 20.4, 15.3 and 6.3 , respectively, (P. value <0.001), (**Table 5 & Figure 3**).

To assess the performance of vitamin D as predictor of severity of psoriasis, Receiver operating characteristic (ROC) curve analysis was conducted (**Figure 4**) and revealed that at an optimal cutoff value of < 20 ng/ml (Identified according to Youden's index), vitamin D level was good predictor of severe disease with a Sensitivity (94.2%), Specificity (90.6%), Accuracy (92.4%), positive predictive value (PPV) of (90.9%) and negative predictive value (NPV) of 94.1%, (**Table 6**). Further analysis was performed to assess the significance of correlation of vitamin D with the severity of psoriasis independent of other variables including age, sex and BMI, we performed logistic regression analysis which revealed that vitamin D was strong predictor of severe disease independent of age and sex and BMI, where patients with lower vitamin D level less than 20 ng/ml about 4-fold more likely to have severe psoriasis (Odds ratio= 4.1, P=0.007). After adjustment for the factors that may contribute to psoriasis severity, including the age, gender and BMI, we found that Vitamin D remain significant good predictor of severe psoriasis independent of other variables, (**Table 7 & Figure 5**).

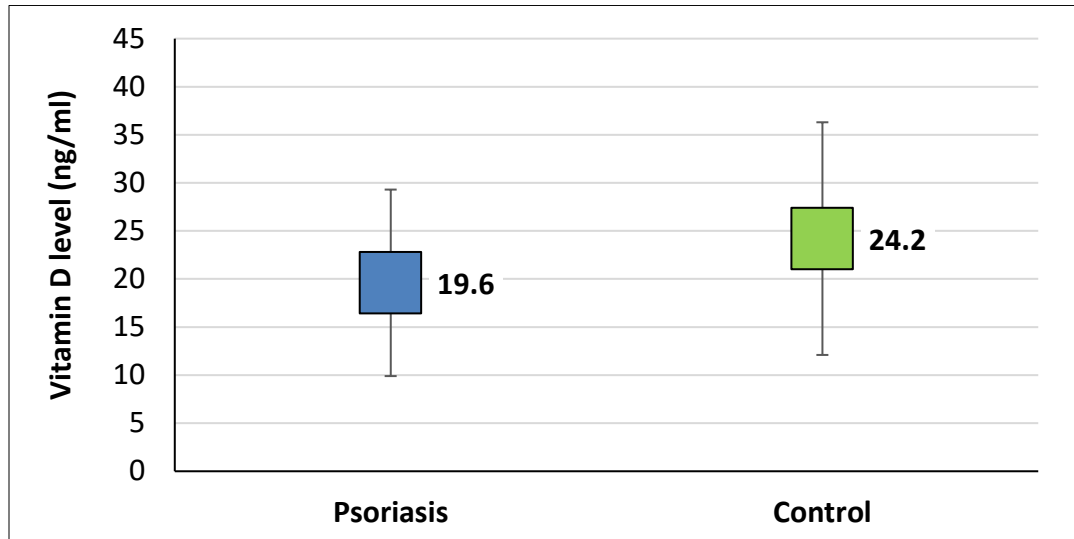
Table 1. Demographic characteristics of Psoriatic and control groups

Variable	Psoriasis		Control		P. value
	No.	%	No.	%	
Age (year)	≤ 30	20	20.0	18	18.0
	31-40	13	13.0	15	15.0
	41-50	33	33.0	36	36.0
	51-60	25	25.0	24	24.0
	> 60	9	9.0	7	7.0
	Mean (SD)	43.5(11.8)	-	42.8(11.2)	-
Gender	Male	52	52.0	53	53.0
	Female	48	48.0	47	47.0
BMI category	Normal	32	32.0	45	45.0
	Overweight	41	41.0	43	43.0
	Obese	27	27.0	12	12.0
	Mean (SD)	27.2(4.9)	-	25.4(3.8)	-
*Significant at the P<0.05, SD: standard deviation					

Table 2. Comparison of Vitamin D levels in psoriasis and control groups

Vitamin D status	Psoriasis		Control		P. value
	No.	%	No.	%	
Deficient	46	46.0	24	24.0	0.002*
Insufficient	31	31.0	35	35.0	
Sufficient	23	23.0	41	41.0	

SD: standard deviation, *significant

**Figure 1. Comparison of serum vitamin D levels in psoriasis and control groups, (P. value <0.001, significant)****Table 3. Distribution of PASI-based severity of disease among 100 psoriatic patients**

Severity grade	No.	%
Mild	21	21.0
Moderate	44	44.0
Severe	35	35.0
Total	100	100.0

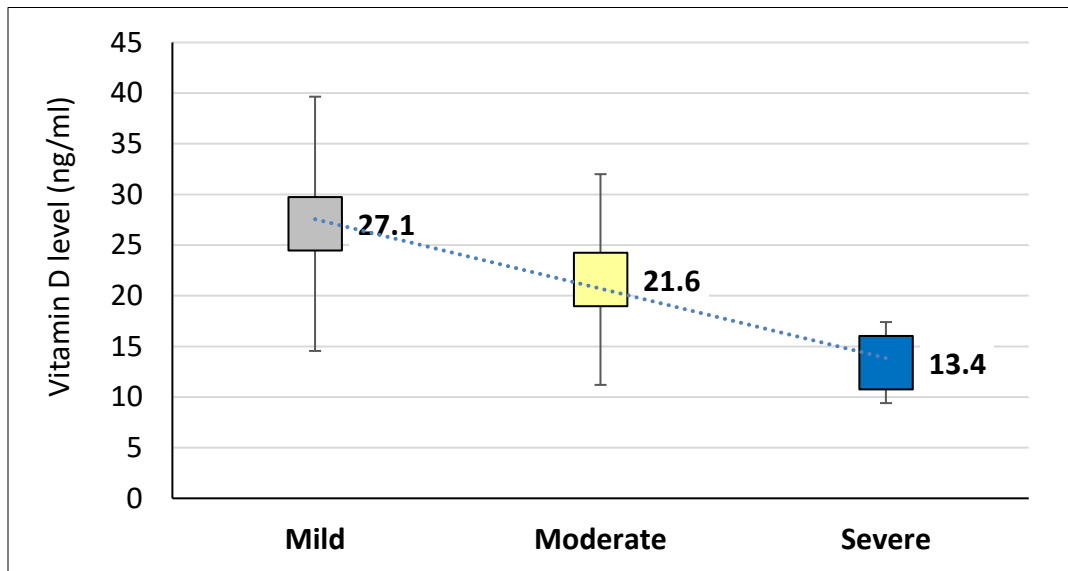
Mean PASI score: 15.6 ± 9.7 , Median: 14.5, range: 6-35

Table 4. Comparison of Vitamin D levels according to PASI-based severity of disease among 100 psoriatic patients

Severity grade	N	Vitamin D level (ng/ml)			
		Mean	SD	Range	95% CI for Mean
Mild	21	27.1	9.6	15.6 – 47.0	21.3 - 32.8
Moderate	44	21.6	6.5	11.1 - 32.0	19.1 – 23.0
Severe	35	13.4	2.4	10.0– 17.8	12.6 - 14.2
Total	100	19.6	8.9	10.0 – 47.0	17.9 - 21.4

ANOVA test, P. value< 0.001, significant

CI: Confidence Interval, SD: standard deviation.

**Figure 2. Line-Marker plot showed the negative trend of change in vitamin D level across the PASI-based severity of psoriasis****Table 5. Comparison of mean total PASI score according to Vitamin D status of psoriatic patients**

Vitamin D status	N	Total PASI score			
		Mean	SD	Range	95% CI for Mean
Deficient	46	20.4	7.7	11.7 - 35.0	18.1 - 22.6
Insufficient	31	15.3	10.4	5.1 - 35.4	11.5 - 19.1
Sufficient	23	6.3	1.6	3.9 - 10.0	5.6 - 6.9
Total	100	15.5	9.5	3.9 - 35.4	13.6 - 17.4

ANOVA test, P. value< 0.001, significant

CI: Confidence Interval, SD: standard deviation.

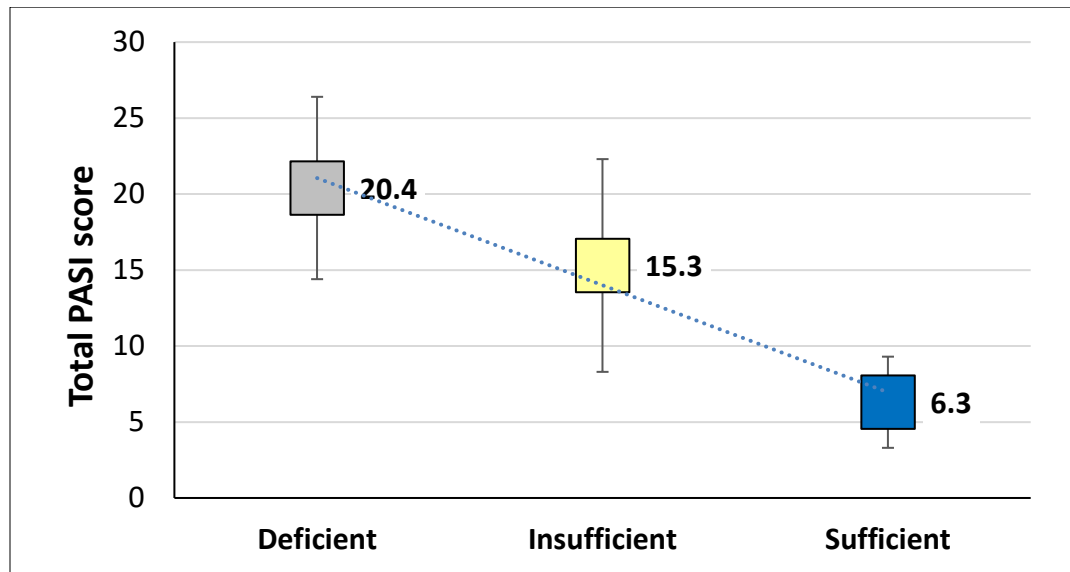


Figure 3. Line-Marker plot showed the negative trend of change in total PASI score across the Vitamin D status among psoriatic patients (N=100)

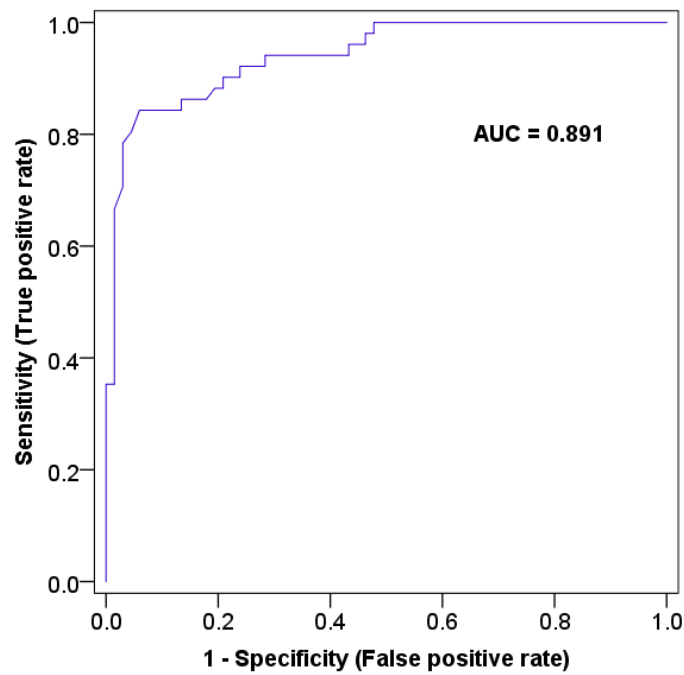


Figure 4. Receiver operating characteristic (ROC) curve for performance of vitamin D as predictor of severe psoriasis

Table 6. Parameters of performance of vitamin D as predictor of severe psoriasis among 100 psoriatic patients

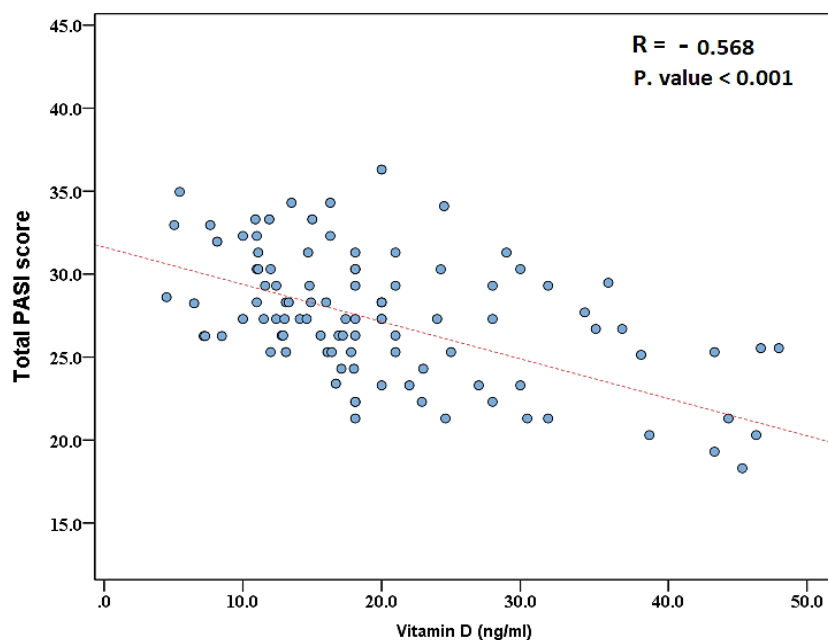
Youden's index	0.869
Optimal cutoff value	< 20 ng/ml
Sensitivity	94.2%
Specificity	90.6%
Accuracy	92.4%
PPV	90.9%
NPV	94.1%

Table 7 . Results of binary logistic regression for the predictors of severe of psoriasis

Predictor	B	SE	Wald	OR	95% C.I. of OR	P. value
Age	0.41	0.31	2.33	1.51	0.82 - 2.79	0.127
Gender	0.32	0.25	2.26	1.37	0.84 - 2.24	0.133
BMI	0.58	0.14	5.88	1.79	1.37 - 2.33	0.015*
Low Vitamin D	1.41	0.31	7.32	4.10	2.21 - 7.58	0.007*

B: coefficient, SE: standard error of B, OR: odds ratio (Exp (B)), CI: confidence interval.

*significant

**Figure 5. Curve estimation-Scatter plot showing the inverse significant correlation between Total PASI score and vitamin D level after adjustment for predictors of vitamin D deficiency**

DISCUSSION:

Psoriasis is a chronic disease causes long life burden on the affected patients, their families and health system in general. The cost of therapy, medical care, loss of productivity, occurrence of comorbidities as well as psychological stress and mental health all can distress the patients' activities in their home and community. No doubt, the more severe disease associated with worsening of patient's health and most aspect of their lives [19]. Therefore, maintaining patients at less severe or minimal to mild disease can improve their quality of life and mental health. Vitamin D deficiency is currently representing pandemic all over the world, and so many studies conducted to correlate the Vitamin D level with different diseases and proved correlation was reported included its association with severity of psoriasis. Hence, keeping the vitamin D level at optimal level may help to prevent severe progression of psoriasis. However, at our setting, most studies compared Vitamin D between psoriasis patients and healthy people [14,15], but few studies were extended to assess the Vitamin D according to severity grade of psoriasis. Our objective in this study is to fill part of the gap in the scientific literature in this field. Therefore, we conducted this case control study as a study participants of our clinical practice and following up of psoriatic patients at our centers as well as the private clinic, the main aim is to assess the Vitamin D levels across the severity categories based on PASI score which is the most widely popular clinical toll used in clinical practice. Furtherly, we assessed the validity of Vitamin D as predictor of severe disease form defined as higher PASI score. The correlation between Vitamin D and PASI score were assessed in two directions; the first by comparing the mean Vitamin D across the severity grade and the second direction was comparing the mean PASI score across the Vitamin D status, this approach supports our hypothesis that lower Vitamin D may associated with more severe psoriasis which was approved in our findings. The studied group were almost matched for age and gender to avoid any confounding effect of these variables on the Vitamin D level and severity of psoriasis. Epidemiological literature stated that matching is an appealing method to avoid confounding [20]. Our findings supported the widely reported results that Vitamin D deficiency is more frequent in psoriasis patients compared to health controls; in Iraq, Al Tajer et al. found that Vitamin D was significantly lower in psoriasis patients compared to healthy controls [15], so as in India Hassan et al. [14] reported similar finding. n the present study we

found a dose-response relationship between Vitamin D level and PASI score, i.e. the diseases severity increased significantly with lowering in Vitamin D. Other finding when we conducted Receiver operating characteristic analysis, we found that Vitamin D was significant predictor of severe psoriasis with high sensitivity, specificity and accuracy. This finding further supported by regression analysis when we adjust for other variables such as age, gender and BMI of the patients because these variables may affect the severity and the Vitamin D levels [21–24], regression analysis revealed that Vitamin D level remains significant strong predictor independent of other variables and that psoriasis patients with low vitamin D levels were about 4-fold more likely to have more severe disease identified by higher PASI score. These findings supported that reported in previous studies; Mohta and Nyati from the Sardar Patel Medical College, in India [25] concluded that Vitamin D deficiency was significantly highly prevalent in psoriasis patients and the Vitamin D level is significantly associated with all aspects of severity of psoriasis and it can predict the progression and the course of disease. In contrast, three previous studies did not find a significant association between Vitamin D and psoriasis or its severity [26–28], the conflicting results could be attributed to multiple factors such as different study designs, sample size, study population background in the context of Vitamin D levels, confounding by Vitamin D supplementation and adiposity as well as variation in the laboratory assay techniques and severity index used in evaluation. However, several factors can affect the Vitamin D levels such as age, gender, exposure to sun light genetics and dietary factors [29]. Interestingly, a meta-analysis included 23 studies with 1876 psoriasis patients and 7532 healthy controls found that 4 studies (clinical trials) tried supplementation of Vitamin D against placebo to psoriasis patients for 3,6 and 12 months. These studies found no significant difference between psoriasis patients and controls in the Vitamin D levels and concluded that Vitamin D supplementation did not improve the clinical manifestations [30]

CONCLUSION:

Our study confirmed a significant negative (inverse) correlation between Vitamin D level and severity of psoriasis where the lower Vitamin D level was found in psoriasis patients with more severe disease identified by the higher PASI score. This correlation was consistent and confirmed across all statistical procedures we did perform including regression analysis and Receiver operating characteristic curve analysis. Vitamin D showed a significant good

performance as predictor for severe psoriasis form with high sensitivity, specificity and accuracy that support the clinical implementation of the routine assessment of Vitamin D status in psoriasis patients particularly those with moderate to severe disease. We also, recommend conducting multicenter studies with larger sample size for more evaluation, comparison and precise conclusions

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