

## ORIGINAL ARTICLE

# Serum Vitamin D and Lipid Profile in Patients with Psoriasis in Bangladesh: A Cross-Sectional Comparative Study

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## ABSTRACT

**Background:** Psoriasis is a chronic immune-mediated inflammatory disorder increasingly seen as a systemic disease with metabolic and cardiovascular comorbidities. Vitamin D plays immunomodulatory roles, and deficiency may exacerbate disease activity and metabolic issues such as dyslipidemia. Evidence from Bangladesh is limited. This study evaluates serum 25(OH)D levels and lipid profiles in Bangladeshi psoriasis patients against matched healthy controls. **Methods & Materials:** This cross-sectional study at Sir Salimullah Medical College Mitford Hospital, Dhaka, from July 2021 to June 2022, enrolled 120 participants: 60 confirmed psoriatic patients and 60 matched healthy controls, selected via purposive convenience sampling. Serum 25(OH)D was measured by immunofluorescence immunoassay, and lipid profiles were assessed enzymatically. Group comparisons used Student's *t*-test and Chi-square test; Pearson correlation analyzed relationships among vitamin D, lipids, and psoriasis duration. **Results:** Psoriatic patients had significantly lower serum 25(OH)D levels ( $14.55 \pm 5.89$  vs.  $33.22 \pm 6.82$  ng/mL;  $p = 0.001$ ) and higher total cholesterol ( $219.00 \pm 20.21$  vs.  $159.53 \pm 14.50$  mg/dL), triglycerides ( $169.60 \pm 32.75$  vs.  $112.47 \pm 20.34$  mg/dL), and LDL-C ( $146.75 \pm 17.74$  vs.  $93.43 \pm 15.55$  mg/dL), with lower HDL-C ( $38.15 \pm 3.47$  vs.  $43.63 \pm 4.69$  mg/dL) (all  $p = 0.001$ ). Vitamin D deficiency ( $<20$  ng/mL) was in 83.5% of psoriatic patients vs. 1.7% of controls. Serum vitamin D negatively correlated with total cholesterol ( $r = -0.699$ ), triglycerides ( $r = -0.630$ ), LDL-C ( $r = -0.687$ ), disease duration ( $r = -0.462$ ), and positively with HDL-C ( $r = +0.569$ ) ( $p < 0.001$ ). **Conclusion:** Patients with psoriasis in Bangladesh exhibited significant vitamin D deficiency and dyslipidemia. Low vitamin D was linked to an atherogenic lipid profile, suggesting a role in cardiometabolic risk.

**Keywords:** Psoriasis, Vitamin D, Dyslipidaemia, Lipid profile, Cardiovascular risk, Bangladesh

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## INTRODUCTION

Psoriasis is a chronic, immune-mediated inflammatory skin disorder affecting approximately 1–3% of the global population. Clinically, it is characterized by well-demarcated erythematous papules and plaques covered with silvery scales, with plaque psoriasis being the most common clinical subtype. [1,2] Although once considered a dermatological condition primarily, psoriasis is now widely recognized as a systemic inflammatory disease with important metabolic and cardiovascular implications. [3]

The prevalence of psoriasis varies significantly across geographic regions, with higher rates reported in Europe than in Asia, where it is generally below 1%. [4] In Bangladesh, the estimated prevalence of psoriasis is approximately 0.7%, and plaque psoriasis accounts for nearly 81% of diagnosed cases. [5] Despite these figures, comprehensive epidemiological data in Bangladesh remain limited, particularly regarding the biochemical and metabolic associations of the disease. [5,6] Existing local studies have identified a considerable burden of comorbid conditions among psoriatic patients, including

hypertension, obesity, dyslipidemia, diabetes mellitus, and metabolic syndrome. [7] One study reported that 37% of psoriasis patients in Bangladesh had dyslipidemia, highlighting the importance of regular lipid monitoring in this population. [8] These findings underscore the systemic nature of psoriasis and emphasize the need for region-specific research to better understand its clinical and metabolic profile in the Bangladeshi context.

The pathogenesis of psoriasis involves a complex interplay between genetic susceptibility, immune dysregulation, and environmental factors. Activation of dendritic cells and T lymphocytes leads to increased production of pro-inflammatory cytokines, particularly tumor necrosis factor-alpha (TNF- $\alpha$ ) and cytokines of the IL-23/IL-17 axis. [9,10] These inflammatory mediators promote keratinocyte hyperproliferation and abnormal differentiation, resulting in sustained cutaneous inflammation and characteristic histopathological changes. [11]

Systemic inflammation in psoriasis is closely linked to metabolic disturbances, especially dyslipidemia. Persistent

elevation of inflammatory cytokines contributes to endothelial dysfunction and altered lipid metabolism, thereby increasing the risk of premature atherosclerosis and cardiovascular disease. [12,13] Consequently, psoriasis is now considered an independent risk factor for cardiometabolic disorders, making evaluation of lipid profile an essential component of patient assessment.

Vitamin D, a fat-soluble secosteroid hormone, plays a crucial role not only in calcium and phosphate homeostasis but also in immune regulation. It exerts its biological effects through binding to the vitamin D receptor (VDR), thereby influencing gene transcription in various tissues. Vitamin D modulates both innate and adaptive immune responses, suppresses pro-inflammatory cytokine production, and inhibits excessive keratinocyte proliferation. [12] Emerging evidence suggests that vitamin D deficiency may contribute to the pathogenesis and severity of psoriasis by dysregulating key inflammatory and T-cell-mediated immune pathways.

Although associations between psoriasis, hypovitaminosis D, and dyslipidemia have been explored in many populations, data from Bangladesh remain scarce. Considering regional variations in sun exposure, dietary habits, and cardiometabolic risk factors, locally generated evidence is essential. Therefore, the present cross-sectional comparative study was undertaken to evaluate serum vitamin D levels and lipid profiles in patients with psoriasis in Bangladesh and to compare them with those of age- and gender-matched healthy controls. Early identification of vitamin D deficiency and dyslipidemia may facilitate improved risk stratification and help reduce long-term cardiovascular complications in this population.

## METHODS & MATERIALS

**Study Design:** This study was a cross-sectional comparative investigation to assess serum vitamin D levels and lipid profiles in patients with psoriasis compared with age- and gender-matched healthy controls. Participants were categorized into two groups. Biochemical parameters were measured once per participant, and the association between vitamin D and the lipid profile was analyzed.

**Study Place:** The research was carried out at the Department of Biochemistry, Sir Salimullah Medical College (SSMC), Mitford Hospital, Dhaka, Bangladesh. All laboratory assessments were conducted in the institution's central biochemistry laboratory, which is equipped with standard automated analyzers and quality control facilities.

**Study Period:** The study was conducted from July 2021 to June 2022. During this period, participants were recruited, clinical data were collected, blood samples were obtained, and laboratory analyses were completed.

**Study Population and Grouping:** A total of 120 participants were included in the study. Sixty patients with clinically diagnosed and histopathologically confirmed psoriasis were recruited from the Dermatology Outpatient Department at SSMC Mitford Hospital. Sixty age- and gender-matched apparently healthy individuals served as controls. Participants were selected using purposive, convenience sampling. Participants were divided into two groups:

- Group A: Psoriatic patients (n = 60)
- Group B: Age- and gender-matched healthy controls (n = 60)

**Sample Size Determination:** The sample size was calculated using the formula for comparing two independent means, based on previously reported serum total cholesterol values.

[14] With a 5% level of significance ( $Z\alpha = 1.96$ ) and 80% statistical power ( $Z\beta = 0.84$ ), the estimated sample size was 59.41 per group. This was rounded up to 60 participants per group, resulting in a total sample size of 120 subjects. The study included patients with clinically diagnosed and histopathologically confirmed psoriasis aged 18 years or older, both sexes, along with age- and gender-matched healthy controls. Participants were excluded if they had other autoimmune or inflammatory diseases, chronic systemic illnesses such as malignancy, chronic liver or kidney disease, cardiovascular or endocrine disorders, a history of medications that affect vitamin D or lipid levels, or were pregnant or lactating.

**Data Collection and Anthropometric Assessment:** Following the acquisition of written informed consent, demographic and clinical data were gathered utilizing a structured questionnaire. Height and weight were measured employing standard procedures. The body mass index (BMI) was computed as weight (kg) divided by height ( $m^2$ ). Waist circumference was measured in accordance with the WHO STEPS protocol. All measurements were conducted by trained personnel.

**Blood Sample Collection:** Venous blood samples were taken after a 10–12 hour overnight fast. About 4 mL of blood was drawn from the antecubital vein using aseptic technique. Serum was separated by centrifuging at 3000 rpm for 10 minutes. The samples were kept at 4–8°C and analyzed within three days. Duplicate samples were stored at -70°C for later use.

**Laboratory Analysis:** Serum total cholesterol (TC), triglycerides (TG), and HDL-C were measured using standard enzymatic methods. LDL-C was calculated using the Friedewald formula. Serum 25-hydroxyvitamin D [25(OH)D] was measured using an immunofluorescence-linked immunoassay. Lipid profile assays were performed using a semi-auto biochemistry analyzer (Humalyser 3000, Germany). Serum vitamin D was measured using an immunoanalyzer (Getein 1100, China). Internal quality control procedures were followed throughout the study. Vitamin D status was categorized as deficiency (<20 ng/mL), insufficiency (20–30 ng/mL), and normal (30–70 ng/mL) according to Holick (2007). Lipid profile cutoff values were defined according to established guidelines (Grundey et al., 2004).

**Statistical Analysis:** Data were analyzed with SPSS version 26.0 (SPSS Inc., Chicago, IL, USA). Continuous variables are presented as mean  $\pm$  standard deviation (SD), while categorical variables are shown as frequencies and percentages. The independent-samples t-test compared group means, and the Chi-square test assessed differences in categorical variables. Pearson's correlation analysis evaluated the relationship between serum vitamin D and lipid parameters. A p-value of less than 0.05 was deemed statistically significant.

## RESULTS

Table 1 shows a total of 120 participants took part in this study, comprising 60 patients with psoriasis (Group A) and 60 age- and gender-matched healthy controls (Group B). Demographic and anthropometric characteristics were similar between the two groups ( $p > 0.05$ ). Serum 25-hydroxyvitamin D [25(OH)D] levels were notably lower in psoriatic patients, while dyslipidemia was more common in Group A. Correlation analysis among psoriatic subjects revealed significant associations among serum vitamin D levels, lipid parameters, and psoriasis duration.

**Table I: Demographic and anthropometric characteristics of study participants (n = 120)**

Variable	Group A (Psoriasis) (n=60)	Group B (Control) (n=60)	P-value
Age (years)	34.65 ± 8.26	37.20 ± 10.26	0.136
Range	20-52	20-62	
<b>Age group, n (%)</b>			
20-30	19 (31.7)	16 (26.6)	
31-40	28 (46.7)	25 (41.7)	
41-50	12 (19.9)	13 (21.7)	
>50	1 (1.7)	6 (10.0)	
Sex, n (%)	0.196		
Male	31 (51.7)	38 (63.3)	
Female	29 (48.3)	22 (36.7)	
Height (cm)	161.25 ± 8.80	162.43 ± 7.14	0.421
Weight (kg)	53.15 ± 7.10	55.16 ± 6.71	0.113
BMI (kg/m <sup>2</sup> )	20.37 ± 1.42	20.87 ± 1.81	0.094

Values are presented as mean ± SD or number (%). P-values were obtained using independent sample t-test for continuous variables and Chi-square test for categorical variables.

Table II shows serum vitamin D levels were significantly lower in psoriatic patients than in controls. The mean serum 25(OH)D level in Group A was 14.55 ± 5.89 ng/mL, whereas in

Group B it was 33.22 ± 6.82 ng/mL (p = 0.001). Vitamin D deficiency (<20 ng/mL) was present in 83.5% of psoriatic patients compared to only 1.7% of controls.

**Table II: Serum 25(OH)D status among study participants (n = 120)**

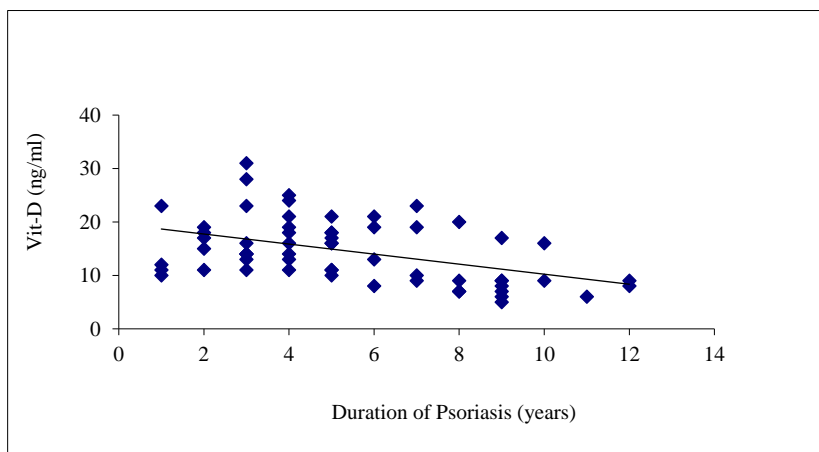
Vit-D (ng/ml)	Group-A (n=60)		Group-B (n=60)		P-value
	n	(%)	n	(%)	
Deficiency (<20 ng/ml)	50	83.5	1	1.7	
Insufficiency (20-30 ng/ml)	9	15.1	19	31.6	
Normal (30-70 ng/ml)	1	1.7	40	66.7	
Mean±SD	14.55±5.89		33.22±6.82		0.001
Range	5-31		19-46		

Table III shows psoriatic patients demonstrated significantly higher mean total cholesterol, triglycerides, and LDL-C compared to controls, while HDL was significantly lower in

Group A. All lipid parameters differed significantly between the two groups (p = 0.001).

**Table III: Comparison of lipid profile parameters between psoriatic patients and controls (n = 120)**

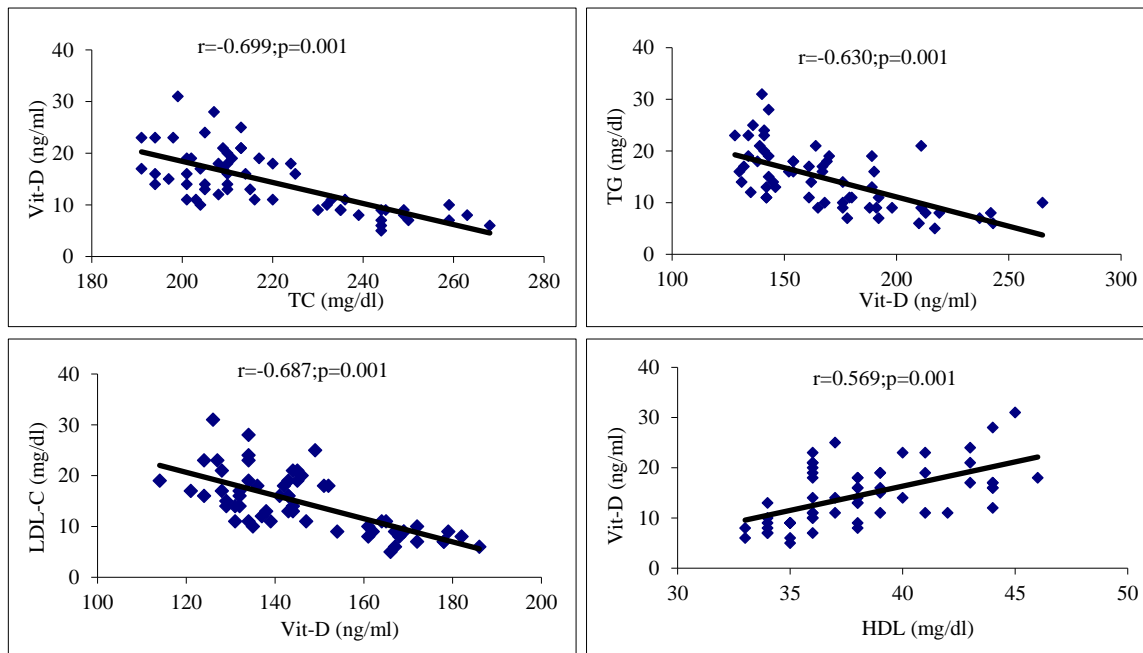
Lipid profile	Group-A (n=60)	Group-B (n=60)	P-value
	Mean± SD	Mean± SD	
TC (mg/dl)	219±20.21	159.53±14.5	0.001
Range	191-268	132-195	
TG (mg/dl)	169.6±32.75	112.47±20.34	0.001
Range	128-265	70-158	
LDL-C (mg/dl)	146.75±17.74	93.43±15.55	0.001
Range	114-186	59-126	
HDL (mg/dl)	38.15±3.47	43.63±4.69	0.001
Range	33-46	37-57	



**Figure 1: Correlation between duration of psoriasis and serum vitamin D**

Figure 1 shows a significant negative correlation between psoriasis duration and serum 25(OH)D levels, indicating that

vitamin D levels decrease as disease duration increases ( $r = -0.462$ ,  $p = 0.001$ ).



**Figure 2: Correlation between serum vitamin D and lipid parameters in psoriatic patients**

This Figure 2 shows that in psoriatic patients, serum vitamin D has significant negative correlations with TC ( $r = -0.699$ ), TG ( $r = -0.630$ ), and LDL-C ( $r = -0.687$ ), while it has a significant positive correlation with HDL-C ( $r = +0.569$ ) (all  $p = 0.001$ ). In other words, lower vitamin D is associated with a more atherogenic lipid profile.

## DISCUSSION

This cross-sectional comparative study demonstrated that patients with psoriasis had significantly lower serum 25-hydroxyvitamin D [25(OH)D] levels and a more atherogenic lipid profile than age- and gender-matched healthy controls. Furthermore, strong inverse correlations were observed between vitamin D levels and total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C), whereas a positive correlation was observed with high-density lipoprotein cholesterol (HDL-C). These findings align with growing evidence linking vitamin D deficiency and dyslipidemia in psoriasis and reinforce concerns about heightened cardiometabolic risk in this population.

In the present study, 83.5% of psoriatic patients exhibited vitamin D deficiency ( $<20$  ng/mL), compared with 1.7% in the control group. Only 1.7% of psoriatic patients maintained normal vitamin D levels, whereas 66.7% of control subjects demonstrated levels within the normal range. This substantial prevalence of hypovitaminosis D among individuals with psoriasis aligns with numerous case-control studies documenting reduced 25(OH)D concentrations in psoriasis patients. [15,16] Similar associations have been documented in observational studies showing a higher prevalence of vitamin D deficiency in psoriatic cohorts than in healthy individuals. [17,18] However, heterogeneity across studies exists. Variations in demographic distribution, geographic location, sun exposure, dietary patterns, and disease-related factors may influence vitamin D status and partly explain discrepancies in reported prevalence. [19,20] These factors should be considered

when interpreting absolute deficiency rates across populations.

The present study demonstrated a clearly unfavorable lipid profile among psoriatic patients. Elevated TC ( $>200$  mg/dL) was observed in 86.7% of psoriatic patients, compared with 0% in controls. Hypertriglyceridemia ( $>150$  mg/dL) was present in 63.3% of psoriatic patients compared with 2.8% of controls. In addition, all psoriatic patients (100%) had LDL-C levels  $>100$  mg/dL, whereas 31.7% of controls exceeded this threshold. Low HDL-C ( $<40$  mg/dL) was found in 75.0% of psoriatic patients compared with 28.3% of controls (all  $p = 0.001$ ).

These findings are concordant with contemporary literature describing pro-atherogenic lipid alterations in psoriasis. [21,22] Recent studies further report qualitative lipid abnormalities in psoriatic populations, including increased small dense LDL and unfavorable ApoB/ApoA1 ratios, suggesting that lipid-associated cardiovascular risk in psoriasis may extend beyond conventional lipid concentrations. [23,24] Study participants may impact lipid findings. Certain studies indicate a predominance of males or higher mean ages, which can alter cardiometabolic risk profiles and lipid patterns. [19,20] Consequently, variability in lipid results across different studies may be attributable to demographic and clinical differences rather than conflicting pathophysiological mechanisms.

A significant strength of this research is demonstrating notable correlations between serum vitamin D levels and lipid parameters among patients with psoriasis. Vitamin D exhibited significant inverse relationships with total cholesterol (TC) ( $r = -0.699$ ,  $p = 0.001$ ), triglycerides (TG) ( $r = -0.630$ ,  $p = 0.001$ ), and low-density lipoprotein cholesterol (LDL-C) ( $r = -0.687$ ,  $p = 0.001$ ). Conversely, a significant positive correlation was observed with high-density lipoprotein cholesterol (HDL-C) ( $r = +0.569$ ,  $p = 0.001$ ). Furthermore, the duration of psoriasis was inversely correlated with serum vitamin D levels ( $r = -0.462$ ,  $p = 0.001$ ),

indicating that extended disease duration may be associated with progressively diminished vitamin D levels.

These biologically plausible and supported by mechanistic and genetic evidence. Mendelian randomization indicates a potential negative causal link between genetically determined vitamin D levels and TG, TC, and LDL-C, suggesting vitamin D's role in lipid regulation. [25] Psoriasis-related systemic inflammation is also recognized to impair cholesterol efflux, modify HDL functionality, and facilitate adverse lipoprotein remodeling, thereby increasing the risk of atherogenesis. [23,25] Given that vitamin D possesses immunomodulatory properties, a deficiency in this vitamin may enhance inflammatory pathways that indirectly exacerbate lipid profiles. Additionally, polymorphisms in the vitamin D receptor and altered receptor expression within immune and skin cells may influence immune activation and subsequent metabolic signaling pathways pertinent to lipid metabolism. [26] The correlation patterns identified in our cohort likely represent both direct metabolic effects and indirect effects mediated by inflammation.

The combination of hypovitaminosis D and a pro-atherogenic lipid profile heightens concerns regarding increased cardiovascular risk among patients with psoriasis. Given the substantially elevated triglyceride (TG) and low-density lipoprotein cholesterol (LDL-C) levels, alongside diminished high-density lipoprotein cholesterol (HDL-C) observed in this cohort, these findings underscore the necessity for comprehensive cardiometabolic evaluation. Prospective cohort and genetic investigations suggest that heightened triglycerides may serve as mediators of cardiovascular risk in psoriasis [25], while imaging studies indicate that lipid quality such as small dense LDL and altered particle size correlates with high-risk coronary plaque features in psoriatic populations. [23] Furthermore, psoriasis often coexists with other cardiometabolic risk factors such as obesity, hypertension, and insulin resistance, thereby amplifying the risk of atherosclerosis. [20,27] Consequently, cardiovascular risk assessment in patients with psoriasis should encompass a meticulous evaluation of lipid profiles and consider vitamin D status as a potentially modifiable contributory factor.

Evidence on the effects of vitamin D supplementation on lipid levels remains heterogeneous. A pilot randomized trial in patients with psoriasis found reductions in TC, LDL-C, and TG and increases in HDL-C with high-dose vitamin D supplementation. [28] However, meta-analyses in metabolic populations report mixed effects, with some showing triglyceride reduction but inconsistent changes in LDL-C and TC. [29,30] These discrepancies likely reflect variations in baseline vitamin D status, dosage and duration of supplementation, sample size, and concurrent therapies. Although psoriasis-specific trials suggest the potential for concurrent improvement in disease severity and lipid profile following vitamin D repletion, [27,28] larger randomized, placebo-controlled studies with standardized dosing regimens and cardiovascular endpoints are required. Future research should also encompass mechanistic outcomes such as inflammatory markers, lipoprotein particle characteristics, and cholesterol efflux capacity to clarify causal pathways.

#### LIMITATION

This study has several strengths, including the use of age- and gender-matched healthy controls, standardized biochemical assessment of serum 25(OH)D and lipid parameters, and additional correlation analysis between vitamin D levels, lipid profile, and disease duration. It also provides important region-specific evidence from Bangladesh, where such data remain limited. However, the findings should be interpreted

considering certain limitations. The cross-sectional design does not allow causal inference, purposive convenient sampling may introduce selection bias, and the single-center setting limits generalizability to the wider Bangladeshi population. In addition, due to time and financial constraints, related markers of vitamin D metabolism such as parathyroid hormone, serum calcium, and phosphate were not measured.

#### CONCLUSION

This study confirms a high prevalence of vitamin D deficiency in psoriatic patients (83.5%) and shows adverse lipid changes, with higher TC, TG, LDL-C, and lower HDL-C compared to controls (all  $p = 0.001$ ). Vitamin D levels are linked to lipid parameters and disease duration, with inverse correlations to TC, TG, LDL-C, and psoriasis duration, and a positive one to HDL-C. These results suggest hypovitaminosis D may be related to dyslipidaemia and cardiovascular risk in psoriasis. Routine testing of lipid profile and vitamin D in psoriatic patients is justified, but expectations for lipid improvement with supplementation should be individualized until more evidence emerges.

#### ETHICAL APPROVAL & CONSENT

Ethical approval was obtained from the Institutional Review Board of Sir Salimullah Medical College Mitford Hospital, Dhaka. Written informed consent was obtained from all participants prior to enrollment. Participants were informed about the study objectives, procedures, and potential risks. Confidentiality was strictly maintained, and participants were free to withdraw from the study at any stage without any consequences.

#### FUNDING

This study was self-funded. No external financial support was received.

#### CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest.

#### AUTHORS' CONTRIBUTIONS

Dr. Md. Moinul Ahsan conceived and designed the study, supervised data collection, and prepared the initial draft of the manuscript. The co-authors contributed to laboratory procedures, statistical analysis, interpretation of findings, and critical revision of the manuscript for important intellectual content. All authors reviewed and approved the final version of the manuscript.

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