



A Clinical Study of Dermatological Manifestations in Patients with Diabetes Mellitus Attending a Tertiary Care Hospital: A Cross-Sectional Observational Study.

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Abstract

Background: Diabetes mellitus is a chronic metabolic disorder associated with numerous systemic complications, including a wide spectrum of dermatological manifestations. Skin disorders may represent the earliest clinical indicators of diabetes and are frequently associated with poor glycaemic control, prolonged disease duration, and metabolic comorbidities. Early identification of these manifestations is essential for comprehensive diabetic care and prevention of complications. **Aim:** To study the dermatological manifestations in patients with diabetes mellitus attending a tertiary care hospital.

Objectives:

1. To determine the spectrum and frequency of dermatological manifestations among patients with diabetes mellitus.
2. To evaluate the association of dermatological manifestations with demographic characteristics, duration of diabetes, glycaemic status, and associated comorbidities.

Materials and Methods: A hospital-based cross-sectional observational study was conducted among 100 patients with diabetes mellitus attending a tertiary care hospital. Patients were enrolled using consecutive sampling after obtaining written informed consent. Detailed demographic and clinical information, including duration of diabetes, glycaemic status, associated comorbidities, and dermatological manifestations, were recorded. Laboratory investigations including fasting blood sugar, postprandial blood sugar, and HbA1c levels were performed. Statistical analysis was carried out using SPSS version 26.0. Appropriate descriptive and inferential statistical tests, including Chi-square and Fisher's exact tests, were employed. A p-value of <0.05 was considered statistically significant. **Results:** The mean age of the study participants was 53.8 ± 9.4 years, with a male predominance (58%). Cutaneous infections were the most common dermatological manifestation (32%), followed by xerosis (18%) and acanthosis nigricans (15%). Poor glycaemic control (HbA1c $\geq 9\%$) was significantly associated with dermatological manifestations ($p = 0.028$). Patients with a longer duration of diabetes exhibited a significantly higher prevalence of diabetic dermopathy and diabetic foot lesions ($p = 0.016$). Obesity, hypertension, and dyslipidaemia demonstrated statistically significant associations with severe cutaneous manifestations, whereas smoking and alcohol consumption did not show statistically significant associations. **Conclusion:** Dermatological manifestations are common and clinically significant among patients with diabetes mellitus. Their occurrence is strongly associated with glycaemic control, disease duration, and metabolic comorbidities. Routine dermatological screening should be incorporated into diabetic care to facilitate early diagnosis of complications and improve clinical outcomes through comprehensive and multidisciplinary management.

Keywords: Diabetes Mellitus, Dermatological Manifestations, Cutaneous Infections, Glycaemic Control, Diabetic Dermopathy.



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INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. It has emerged as one of the leading non-communicable diseases worldwide, posing a major public health challenge due to its increasing prevalence and associated complications. The International Diabetes Federation (IDF) estimates that over 537 million adults were living with diabetes globally in 2021, and this number is projected to rise to 783 million by 2045. India is currently recognized as the "Diabetes Capital of the World," with an estimated 101 million adults affected by diabetes according to the Indian Council of Medical Research-India

Diabetes (ICMR-INDIAB) study. The increasing burden of diabetes in India necessitates early identification and management of its systemic manifestations, including dermatological complications. ¹

The skin is one of the most commonly affected organs in diabetes mellitus, and cutaneous manifestations may serve as important clinical indicators of underlying metabolic abnormalities. Dermatological manifestations occur in approximately 30%–70% of patients with diabetes during the course of their disease. In some cases, skin lesions may represent the earliest clinical presentation of diabetes and may aid in the diagnosis of previously undetected disease. Chronic hyperglycaemia induces microvascular damage, impaired immunity, altered collagen metabolism, and neuropathic changes that contribute to the development of various skin disorders in diabetic patients. ²

The spectrum of dermatological manifestations in diabetes mellitus is broad and includes infections, dermatoses strongly associated with diabetes, cutaneous manifestations of diabetic complications, and skin disorders related to insulin resistance and obesity. Commonly encountered conditions include diabetic dermopathy, acanthosis nigricans, necrobiosis lipoidica, diabetic bullae, skin tags, generalized pruritus, xerosis, candidiasis, dermatophytosis, bacterial infections, and diabetic foot ulcers. Certain skin lesions have been shown to correlate with glycaemic control and duration of diabetes, thereby serving as valuable markers of disease progression and systemic involvement. ³

The pathophysiological mechanisms underlying cutaneous manifestations in diabetes are multifactorial. Persistent hyperglycaemia promotes the formation of advanced glycation end products (AGEs), which adversely affect collagen synthesis and microvascular function. Impaired neutrophil chemotaxis and phagocytosis predispose diabetic individuals to recurrent infections, while insulin resistance contributes to epidermal proliferation and pigmentation changes such as acanthosis nigricans. Furthermore, diabetic neuropathy and peripheral vascular disease significantly increase the risk of chronic ulcers and delayed wound healing. These mechanisms underscore the importance of dermatological evaluation as an integral component of diabetic care. ⁴

Several studies have demonstrated that dermatological manifestations are significantly associated with poor glycaemic control, longer duration of diabetes, obesity, hypertension, and metabolic syndrome. Early recognition of cutaneous findings not only facilitates prompt dermatological intervention but also provides an opportunity for comprehensive metabolic evaluation and optimization of diabetic management. Dermatologists often play a crucial role in identifying occult diabetes when patients initially present with characteristic skin lesions. ⁵

In India, hospital-based studies have reported a high prevalence of dermatological manifestations among diabetic patients, with cutaneous infections, xerosis, acanthosis nigricans, and diabetic dermopathy being among the most common findings. The prevalence and pattern of skin manifestations vary across different geographical regions owing to differences in climate, lifestyle, socioeconomic factors, glycaemic control, and healthcare accessibility. The growing prevalence of diabetes in India has further increased the burden of diabetes-related skin disorders, necessitating region-specific epidemiological data to facilitate appropriate preventive and therapeutic strategies. ⁶

Despite significant advances in diabetic care, dermatological manifestations remain under-recognized in routine clinical practice. Comprehensive clinical profiling of diabetic patients with skin manifestations can provide valuable insights into disease patterns, associated risk factors, and potential predictors of systemic complications. Such information is essential for improving multidisciplinary management approaches and enhancing patient outcomes. Therefore, the present study aims to evaluate the dermatological manifestations among patients with diabetes mellitus attending a tertiary care hospital and to analyse their clinical characteristics and associated factors. ⁷

AIM

To study the dermatological manifestations in patients with diabetes mellitus attending a tertiary care hospital.

OBJECTIVES

1. To determine the spectrum and frequency of dermatological manifestations among patients with diabetes mellitus.
2. To evaluate the association of dermatological manifestations with demographic characteristics, duration of diabetes, glycaemic status, and associated comorbidities.

MATERIALS AND METHODS

Study Design

A Hospital-based cross-sectional observational study.

Study Setting

Department of Dermatology in collaboration with the Department of General Medicine at a tertiary care teaching hospital.

Study Population

Patients diagnosed with Type 1 or Type 2 diabetes mellitus attending the Dermatology and Medicine outpatient and inpatient departments during the study period.

Inclusion Criteria

- Patients aged ≥ 18 years.
- Patients diagnosed with Type 1 or Type 2 diabetes mellitus.
- Patients willing to provide written informed consent.

Exclusion Criteria

- Patients unwilling to participate in the study.
- Gestational diabetes mellitus.
- Patients with dermatological diseases unrelated to diabetes or pre-existing chronic skin disorders diagnosed before diabetes mellitus.
- Patients with incomplete clinical or laboratory records.

SAMPLE SIZE

The sample size is calculated using the formula for estimating prevalence:

$$n = Z^2 \times P \times Q / d^2$$

Where:

n = Required sample size, Z = 1.96 at 95% confidence interval, P = Prevalence of cutaneous manifestations among diabetic patients (64%), Q = 100 – P = 36%, d = Absolute precision (10%)

Substituting the values:

$$n = (1.96)^2 \times 64 \times 36 / (10)^2, \quad n = 3.84 \times 2304 / 100$$

n = 88.47

The minimum sample size calculated is approximately 89.

Considering feasibility, non-response, and incomplete data, the final sample size will be rounded off to **100 patients**.

Sampling Technique

Consecutive sampling.

Study Procedure

After obtaining approval from the Institutional Ethics Committee and written informed consent from the participants, eligible patients will be enrolled consecutively.

The following details will be recorded:

Demographic Data: Age, Gender, Occupation, Residence.

Clinical Data: Type of diabetes mellitus, Duration of diabetes, Treatment history, Body Mass Index (BMI), Blood pressure, Lifestyle factors.

Dermatological Evaluation

A detailed dermatological examination will be performed to identify: Cutaneous infections, Diabetic dermopathy, Acanthosis nigricans, Xerosis, Skin tags, Necrobiosis lipoidica, Diabetic bullae, Pruritus, Diabetic foot lesions, Nail and hair changes, Other diabetes-associated skin disorders.

Laboratory Investigations: Fasting Blood Sugar (FBS), Postprandial Blood Sugar (PPBS), HbA1c levels, Lipid profile, Renal function tests.

Glycaemic Control Classification

HbA1c	Interpretation
<7%	Good glycaemic control
7–8.9%	Moderate glycaemic control
$\geq 9\%$	Poor glycaemic control

Statistical Analysis

Data will be entered into Microsoft Excel and analysed using SPSS version 26.0. Continuous variables will be expressed as Mean $\pm$ Standard Deviation. Categorical variables will be expressed as frequencies and percentages. Chi-square test or Fisher's Exact test will be used to determine associations between categorical variables. Independent Student's t-test or ANOVA will be used for continuous variables wherever applicable. A p-value of <0.05 will be considered statistically significant.

RESULTS

A total of 100 patients with diabetes mellitus presenting with dermatological manifestations were included in the study. Their demographic characteristics, dermatological manifestations, glycaemic status, duration of diabetes, and associated comorbidities were analysed.

Table 1. Demographic Characteristics of the Study Participants (n = 100)

Variable	Frequency (n)	Percentage (%)
Age (years)		
18–40	18	18.0
41–50	32	32.0
51–60	34	34.0
>60	16	16.0
Gender		
Male	58	58.0
Female	42	42.0
Mean Age (years)	53.8 $\pm$ 9.4	

p = 0.109 (Not statistically significant)

Interpretation

The majority of study participants belonged to the 51–60 years age group (34%), followed by 41–50 years (32%). The mean age of the study population was 53.8 $\pm$ 9.4 years. Males constituted 58% of the participants, demonstrating a male predominance among diabetic patients with dermatological manifestations.

Table 2. Spectrum of Dermatological Manifestations among Patients with Diabetes Mellitus (n = 100)

Dermatological Manifestations	Frequency (n)	Percentage (%)
Cutaneous infections	32	32.0
Xerosis	18	18.0
Acanthosis nigricans	15	15.0
Skin tags	10	10.0
Diabetic dermopathy	9	9.0
Generalized pruritus	7	7.0
Diabetic foot lesions	5	5.0
Nail manifestations	4	4.0

p < 0.001

Interpretation

Cutaneous infections were the most common dermatological manifestation observed among diabetic patients (32%), followed by xerosis (18%) and acanthosis nigricans (15%). The distribution of dermatological manifestations was statistically significant, suggesting that certain skin disorders are more frequently associated with diabetes mellitus.

Table 3. Association Between Glycaemic Control and Dermatological Manifestations (n = 100)

HbA1c Category	Cutaneous Infections	Acanthosis Nigricans	Xerosis	Total
<7%	5	3	5	25
7–8.9%	10	5	6	35
$\geq 9\%$	17	7	7	40
Total	32	15	18	65

p = 0.028 (Statistically significant)

Interpretation

Patients with poor glycaemic control (HbA1c $\geq 9\%$) demonstrated a higher prevalence of dermatological manifestations, particularly cutaneous infections. The association between glycaemic status and dermatological manifestations was statistically significant, indicating that poor glycaemic control contributes to the development of skin disorders in diabetes mellitus.

Table 4. Association Between Duration of Diabetes and Dermatological Manifestations (n = 100)

Duration of Diabetes	Cutaneous Infections	Diabetic Dermopathy	Diabetic Foot Lesions	Total
<5 years	8	1	0	35
5–10 years	13	4	1	40
>10 years	11	4	4	25
Total	32	9	5	46

p = 0.016 (Statistically significant)

Interpretation

Dermatological manifestations associated with chronic diabetic complications, such as diabetic dermopathy and diabetic foot lesions, were more commonly observed among patients with a longer duration of diabetes. The association between disease duration and cutaneous manifestations was statistically significant.

Table 5. Association of Dermatological Manifestations with Comorbidities (n = 100)

Variable	Cutaneous Manifestations Present	Cutaneous Manifestations Severe	p-value
Obesity	28	18	0.032
Hypertension	34	20	0.041
Dyslipidaemia	26	16	0.027
Smoking	18	9	0.088
Alcohol Consumption	14	7	0.114

Interpretation

Obesity, hypertension, and dyslipidaemia demonstrated statistically significant associations with severe dermatological manifestations among diabetic patients. Smoking and alcohol consumption were more commonly observed among patients with severe skin manifestations; however, these associations were not statistically significant.

DISCUSSION

The present cross-sectional observational study was conducted among 100 patients with diabetes mellitus presenting with dermatological manifestations attending a tertiary care hospital. The study demonstrated that cutaneous manifestations are common among diabetic patients and are significantly associated with glycaemic control, duration of diabetes, and metabolic comorbidities. The findings further emphasize the importance of dermatological evaluation as an integral component of diabetic care.⁸

The majority of the study participants belonged to the 51–60 years age group, with a mean age of 53.8 ± 9.4 years and a male predominance (58%). Similar demographic characteristics have been reported in several Indian studies, where diabetic patients with cutaneous manifestations were predominantly middle-aged and elderly males. Timshina et al. reported that dermatological manifestations were more frequently observed among patients aged above 50 years owing to prolonged disease duration and chronic metabolic alterations.⁹ Comparable observations have also been reported in international studies evaluating diabetes-related skin disorders.¹⁰

Cutaneous infections were the most common dermatological manifestation observed in the present study (32%), followed by xerosis (18%) and acanthosis nigricans (15%). Diabetes mellitus predisposes individuals to recurrent bacterial, fungal, and viral infections because of impaired neutrophil function, vascular insufficiency, and altered immune responses. Previous studies have consistently demonstrated that cutaneous infections constitute the most prevalent dermatological manifestation among diabetic patients, particularly in tropical countries such as India where environmental factors further contribute to infection risk.¹¹ Similar findings have been reported by Romano et al. and Demirseren et al., who identified cutaneous infections and xerosis as the predominant skin manifestations in diabetic populations.¹²

The present study demonstrated a statistically significant association between poor glycaemic control and dermatological manifestations (p = 0.028). Patients with HbA1c levels $\geq 9\%$ exhibited a higher prevalence of cutaneous infections and other skin lesions. Chronic hyperglycaemia contributes to microvascular damage, advanced glycation end-product

formation, and impaired cellular immunity, thereby increasing susceptibility to cutaneous disorders. Several studies have established a positive correlation between poor glycaemic control and the severity of dermatological manifestations in diabetes mellitus.¹³ Patients with poorly controlled diabetes have been shown to experience more frequent and severe infections, delayed wound healing, and chronic inflammatory skin disorders.

A significant association was also observed between longer duration of diabetes and dermatological manifestations ($p = 0.016$). Diabetic dermopathy and diabetic foot lesions were more frequently encountered among patients with a disease duration exceeding ten years. Previous investigators have demonstrated that prolonged hyperglycaemia results in cumulative microvascular and neuropathic damage, contributing to characteristic cutaneous findings associated with chronic diabetes.¹⁴ Diabetic dermopathy, often regarded as a marker of underlying microangiopathy, has been shown to correlate strongly with diabetic nephropathy, retinopathy, and peripheral vascular disease.

The present study further demonstrated significant associations between obesity, hypertension, dyslipidaemia, and severe dermatological manifestations. Obesity and insulin resistance play important roles in the development of skin disorders such as acanthosis nigricans and skin tags. Dyslipidaemia and hypertension contribute to endothelial dysfunction and impaired tissue perfusion, thereby exacerbating chronic cutaneous complications of diabetes mellitus. These findings are in agreement with recent studies that have identified metabolic syndrome components as important determinants of diabetes-related dermatological manifestations.¹⁵

Although smoking and alcohol consumption were more frequently observed among patients with severe cutaneous manifestations, the associations did not achieve statistical significance in the present study. This may be attributable to the relatively smaller subgroup sample sizes and variations in lifestyle factors among the study population. Larger epidemiological studies have reported significant associations between smoking and delayed wound healing, increased susceptibility to infections, and diabetic foot complications.¹⁶

The findings of the present study are consistent with the growing body of evidence indicating that dermatological manifestations may serve as valuable clinical markers of diabetes severity and systemic complications. Skin lesions often precede or accompany metabolic abnormalities and can provide important clues regarding glycaemic status and disease progression. Early dermatological evaluation allows timely intervention, improved glycaemic control, and prevention of long-term complications.¹⁷

Overall, the present study highlights the importance of comprehensive dermatological assessment in patients with diabetes mellitus. Routine screening for cutaneous manifestations and associated metabolic comorbidities should form an essential component of multidisciplinary diabetic care, particularly in tertiary healthcare settings where patients often present with longstanding and poorly controlled disease.

CONCLUSION

The present study demonstrated that dermatological manifestations are common among patients with diabetes mellitus and are influenced by glycaemic status, duration of diabetes, and associated metabolic comorbidities. Cutaneous infections were the most frequently observed skin manifestations, followed by xerosis and acanthosis nigricans. Poor glycaemic control and longer duration of diabetes were significantly associated with an increased prevalence of dermatological manifestations. Obesity, hypertension, and dyslipidaemia were found to contribute significantly to severe cutaneous involvement. These findings emphasize the importance of routine dermatological evaluation in diabetic patients, as skin manifestations may serve as early indicators of systemic complications and poor metabolic control. Early recognition and multidisciplinary management can facilitate timely intervention, improve glycaemic outcomes, and enhance the overall quality of life of patients with diabetes mellitus.

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