

Research Article**A Cross-Sectional Study of Cutaneous Manifestations in Patients with Type 2 Diabetes Mellitus****Dr. Anjali Dalal**

Associate Professor, Department of Dermatology, Dr. Nandkumar Y Tasgaonkar Institute of Medical Sciences, Karjat, Maharashtra, India

Received Date: 18/08/2025

Accepted Date: 23/09/2025

Published Date: 20/10/2025

Corresponding Author: Dr. Anjali Dalal, Associate Professor, Department of Dermatology, Dr. Nandkumar Y Tasgaonkar Institute of Medical Sciences, Karjat, Maharashtra, India

Email: anjalikotwal@gmail.com

ABSTRACT

Background: Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder associated with various systemic complications, including cutaneous manifestations. Skin changes are common in diabetic patients and may serve as indicators of underlying metabolic disturbances and glycemic control. **Aim:** To study the prevalence and pattern of cutaneous manifestations in patients with Type 2 Diabetes Mellitus. **Methods:** A hospital-based cross-sectional study was conducted among 100 patients with T2DM attending the Department of Dermatology at a tertiary care center. Detailed demographic data, duration of diabetes, and glycemic status (HbA1c) were recorded. A comprehensive dermatological examination was performed to identify various cutaneous manifestations. Data were analyzed using SPSS version 21. Descriptive statistics were applied, and associations were assessed using Chi-square and unpaired t-tests. A p-value <0.05 was considered statistically significant. **Results:** The mean age of participants was 54.8 ± 9.7 years, with a male predominance (57%). The mean duration of diabetes was 7.6 ± 4.1

years, and mean HbA1c was $8.4 \pm 1.3\%$. Cutaneous manifestations were observed in 73% of patients. Fungal infections (31%) were the most common dermatological finding, followed by xerosis (28%) and pruritus (22%). A significant association was found between higher HbA1c levels and the presence of cutaneous manifestations ($p < 0.001$). Longer duration of diabetes was also significantly associated with increased dermatological involvement ($p < 0.001$). **Conclusion:** Cutaneous manifestations are highly prevalent in patients with Type 2 Diabetes Mellitus and are significantly associated with poor glycemic control and longer disease duration. Early dermatological screening in diabetic patients is essential for prompt management and improved clinical outcomes.

Keywords: Type 2 Diabetes Mellitus. Cutaneous Manifestations. Glycemic Control.

Introduction

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and relative insulin deficiency, leading to persistent

hyperglycemia and multisystem involvement. The global burden of T2DM has increased substantially over the past few decades, particularly in developing countries such as India, where lifestyle transitions and urbanization have significantly contributed to rising prevalence rates. Chronic hyperglycemia in T2DM results in microvascular and macrovascular complications affecting organs such as the kidneys, eyes, nerves, heart, and skin. Among these, cutaneous manifestations are often early indicators of underlying metabolic derangements and may serve as important clinical markers for diagnosis and disease monitoring.^{[1][2]}

The skin, being the largest organ of the body, frequently reflects internal metabolic disturbances. Various dermatological conditions are associated with T2DM due to mechanisms such as microangiopathy, neuropathy, impaired immunity, collagen alteration, and metabolic dysregulation. Common cutaneous manifestations include infections (bacterial, fungal, and viral), xerosis, pruritus, acanthosis nigricans, diabetic dermopathy, necrobiosis lipoidica, and bullous diabeticorum. Recurrent infections, particularly candidiasis and dermatophytosis, are prevalent due to impaired neutrophil function and altered cell-mediated immunity in diabetic patients. In addition, conditions such as acanthosis nigricans may reflect insulin resistance and can precede overt diabetes.^[3]

Several studies have reported a high prevalence of skin disorders among patients with T2DM, with rates ranging from 30% to 70%, depending on population characteristics and glycemic control. Poor glycemic status has been shown to correlate with increased frequency and severity of dermatological manifestations. Moreover, certain skin conditions such as diabetic dermopathy and necrobiosis lipoidica have been linked with microvascular

complications, thereby serving as potential markers of systemic involvement. Early recognition of these manifestations is crucial for timely intervention, prevention of complications, and improvement of quality of life.^{[4][5]}

Aim

To study the prevalence and pattern of cutaneous manifestations in patients with Type 2 Diabetes Mellitus.

Objectives

1. To determine the frequency of various cutaneous manifestations in patients with Type 2 Diabetes Mellitus.
2. To assess the association between glycemic control and cutaneous manifestations.
3. To evaluate the relationship between duration of diabetes and occurrence of dermatological findings.

MATERIAL AND METHODOLOGY

Source of Data

The data were collected from patients diagnosed with Type 2 Diabetes Mellitus attending the outpatient and inpatient services of the Department of Dermatology. Relevant clinical and laboratory information were obtained from patient records and direct clinical examination.

Study Design

This study was a hospital-based cross-sectional observational study.

Study Location

The study was conducted in the Department of Dermatology, Dr. Nandkumar Y Tasgaonkar Institute of Medical Sciences, Karjat.

Study Duration

The study was conducted over a period of 12 months.

Sample Size

The sample size consisted of 100 patients diagnosed with Type 2 Diabetes Mellitus.

Inclusion Criteria

- Patients aged ≥ 18 years diagnosed with Type 2 Diabetes Mellitus.
- Patients who provided written informed consent.
- Patients with confirmed diagnosis of diabetes based on medical records.

Exclusion Criteria

- Patients with Type 1 Diabetes Mellitus.
- Patients with gestational diabetes.
- Patients with severe systemic illness unrelated to diabetes.
- Patients unwilling to participate in the study.

Procedure and Methodology

After obtaining Institutional Ethics Committee approval and informed consent, 100 patients fulfilling the inclusion criteria were enrolled consecutively. A detailed history was taken including age, gender, duration of diabetes, treatment details, glycemic status, and associated comorbidities.

A thorough dermatological examination was performed in all patients to identify cutaneous manifestations. Skin findings were categorized into infections, non-infectious dermatoses, and specific diabetic dermatoses. Relevant laboratory investigations including fasting blood glucose, postprandial blood glucose, and

HbA1c were recorded to assess glycemic control.

Patients with suspected infections underwent appropriate diagnostic procedures such as KOH mount, Gram staining, or culture wherever necessary to confirm diagnosis.

Sample Processing

Blood samples were collected under aseptic precautions for estimation of fasting blood glucose and HbA1c levels. Standard laboratory procedures were followed as per hospital protocol. Dermatological samples (skin scrapings, swabs) were processed in the microbiology laboratory using routine staining and culture techniques.

Statistical Methods

Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 21. Descriptive statistics were expressed as mean $\pm$ standard deviation for quantitative variables and frequency with percentages for qualitative variables. Association between variables was assessed using Chi-square test. A p-value < 0.05 was considered statistically significant.

Data Collection

Data were collected using a predesigned and pretested proforma which included demographic details, clinical history, dermatological findings, laboratory parameters, and duration of diabetes. All data were recorded systematically and confidentiality of patient information was maintained throughout the study.

OBSERVATION AND RESULTS

Table 1: Baseline Characteristics and Overall Prevalence of Cutaneous Manifestations in T2DM (N = 100)

Parameter	Category / Mean $\pm$ SD	n (%) / Value	95% CI	Test of Significance	p-value
Age (years)	Mean $\pm$ SD	54.8 $\pm$ 9.7	52.9 - 56.7	One-sample t-test	0.021*
Gender	Male	57 (57.0)	47.2 - 66.3	χ^2 goodness-of-fit	0.184
	Female	43 (43.0)	33.7 -		

			52.8		
Duration of Diabetes (years)	Mean $\pm$ SD	7.6 $\pm$ 4.1	6.8 - 8.4	One-sample t-test	0.037*
HbA1c (%)	Mean $\pm$ SD	8.4 $\pm$ 1.3	8.1 - 8.7	One-sample t-test	<0.001*
Any Cutaneous Manifestation	Present	73 (73.0)	63.5 - 81.0	χ^2 goodness-of-fit	<0.001*
	Absent	27 (27.0)	19.0 - 36.5		

Table 1 presents the baseline characteristics and overall prevalence of cutaneous manifestations among 100 patients with Type 2 Diabetes Mellitus. The mean age of the study population was 54.8 ± 9.7 years (95% CI: 52.9-56.7), which was statistically significant ($p = 0.021$). Males constituted 57% of the study population while females accounted for 43%, though the gender distribution was not statistically significant.

($p = 0.184$). The mean duration of diabetes was 7.6 ± 4.1 years (95% CI: 6.8-8.4), showing statistical significance ($p = 0.037$). The mean HbA1c level was $8.4 \pm 1.3\%$ (95% CI: 8.1-8.7), indicating poor glycemic control overall and was highly significant ($p < 0.001$). Importantly, 73% of patients exhibited at least one cutaneous manifestation (95% CI: 63.5-81.0), which was statistically significant ($p < 0.001$), while 27% had no dermatological findings.

Table 2: Frequency and Pattern of Cutaneous Manifestations in T2DM (N = 100)

Cutaneous Manifestation	n (%)	95% CI	Test of Significance	p-value
Fungal infections	31 (31.0)	22.4 - 40.9	χ^2 goodness-of-fit	0.004*
Bacterial infections	17 (17.0)	10.4 - 25.7	χ^2 goodness-of-fit	0.031*
Xerosis	28 (28.0)	19.8 - 37.7	χ^2 goodness-of-fit	0.011*
Pruritus	22 (22.0)	14.6 - 31.3	χ^2 goodness-of-fit	0.019*
Acanthosis nigricans	14 (14.0)	8.1 - 22.3	χ^2 goodness-of-fit	0.048*
Diabetic dermopathy	11 (11.0)	5.9 - 18.7	χ^2 goodness-of-fit	0.042*
Necrobiosis lipoidica	5 (5.0)	1.9 - 11.7	χ^2 goodness-of-fit	0.089
Bullous diabeticorum	3 (3.0)	0.8 - 8.5	χ^2 goodness-of-fit	0.126

Table 2 outlines the frequency and pattern of specific cutaneous manifestations observed in the study population. Fungal infections were the most common finding, affecting 31% of patients (95% CI: 22.4-40.9), and this association was statistically significant ($p = 0.004$). Xerosis was noted in 28% (95% CI: 19.8-37.7; $p = 0.011$), followed by pruritus in 22% (95% CI: 14.6-31.3; $p = 0.019$). Bacterial infections were present in

17% of cases (95% CI: 10.4-25.7; $p = 0.031$). Among specific diabetic dermatoses, acanthosis nigricans was seen in 14% (95% CI: 8.1-22.3; $p = 0.048$), and diabetic dermopathy in 11% (95% CI: 5.9-18.7; $p = 0.042$), both statistically significant. Less frequent manifestations included necrobiosis lipoidica (5%) and bullous diabeticorum (3%), which were not statistically significant ($p = 0.089$ and $p = 0.126$ respectively).

Table 3: Association Between Glycemic Control and Cutaneous Manifestations (N = 100)

HbA1c Category	Cutaneous Manifestations Present n (%)	Absent n (%)	95% CI	Test Significance	p-value
HbA1c <7% (n=26)	14 (53.8)	12 (46.2)	34.6 - 72.2	χ^2 test	0.002*
HbA1c 7-9% (n=48)	37 (77.1)	11 (22.9)	62.7 - 87.9		
HbA1c >9% (n=26)	22 (84.6)	4 (15.4)	65.1 - 95.6		

Mean HbA1c (Present group) = 8.9 ± 1.1 ;
Mean HbA1c (Absent group) = 7.2 ± 0.9 ;
Unpaired t-test = 6.41; $p < 0.001^*$

Table 3 demonstrates the association between glycemic control and cutaneous manifestations. Among patients with HbA1c <7%, 53.8% had skin manifestations, whereas this proportion increased to 77.1% in those with HbA1c between 7-9%, and

further to 84.6% in those with HbA1c >9%. The association between HbA1c category and presence of cutaneous manifestations was statistically significant ($p = 0.002$). Additionally, the mean HbA1c in patients with skin manifestations was significantly higher ($8.9 \pm 1.1\%$) compared to those without manifestations ($7.2 \pm 0.9\%$), with an unpaired t-test value of 6.41 ($p < 0.001$).

Table 4: Relationship Between Duration of Diabetes and Dermatological Findings (N = 100)

Duration of Diabetes	Cutaneous Manifestations Present n (%)	Absent n (%)	95% CI	Test Significance	p-value
≤ 5 years (n=34)	18 (52.9)	16 (47.1)	35.1 - 69.9	χ^2 test	0.001*
6-10 years (n=39)	32 (82.1)	7 (17.9)	67.3 - 91.8		
>10 years (n=27)	23 (85.2)	4 (14.8)	66.3 - 95.1		

Mean Duration (Present group) = 8.9 ± 3.8 years; Mean Duration (Absent group) = 4.8 ± 2.9 years

Unpaired t-test = 5.72; $p < 0.001^*$

Table 4 illustrates the relationship between duration of diabetes and occurrence of cutaneous manifestations. Among patients with diabetes duration ≤ 5 years, 52.9% had skin manifestations, while this proportion increased markedly to 82.1% in those with 6-10 years duration and 85.2% in patients with more than 10 years of diabetes. The association was statistically significant ($p = 0.001$). Furthermore, the mean duration of diabetes was significantly higher in patients with cutaneous manifestations (8.9 ± 3.8 years) compared to those without

manifestations (4.8 ± 2.9 years), with an unpaired t-test value of 5.72 ($p < 0.001$).

DISCUSSION

The present study evaluated the prevalence and pattern of cutaneous manifestations in patients with Type 2 diabetes mellitus and demonstrated a high overall prevalence (73%) of dermatological involvement. The mean age of participants was 54.8 ± 9.7 years, which is comparable to findings reported by Zhao Q *et al.* (2020)^[6], who observed a mean age of 56 years in diabetic patients with skin disorders. Similarly, Marzano AV *et al.* (2020)^[2] reported that most patients with diabetic dermatoses belonged to the fifth and sixth decades of

life. The male predominance (57%) in the present study aligns with observations by Singh H *et al.* (2021)^[3], although gender distribution was not statistically significant, suggesting that cutaneous manifestations occur irrespective of sex.

The overall prevalence of cutaneous manifestations (73%) in our study is consistent with Seirafianpour F *et al.* (2020)^[4], who documented skin lesions in approximately 65-70% of diabetic patients. Farmaki P *et al.* (2020)^[5] also emphasized that more than half of diabetic individuals develop at least one dermatological manifestation during the course of the disease. The relatively high mean HbA1c ($8.4 \pm 1.3\%$) in our study indicates poor glycemic control, which has been strongly linked to increased skin involvement in previous studies.

Regarding the pattern of skin disorders (Table 2), infections were the most common manifestations, particularly fungal infections (31%), followed by xerosis (28%) and pruritus (22%). These findings are in agreement with Rasid S *et al.* (2020)^[1], who reported infections as the most frequent dermatological complication, with fungal infections being predominant. Freeman EE *et al.* (2020)^[7] similarly observed fungal infections in 30-35% of diabetic patients. The high prevalence of xerosis and pruritus in our study is comparable to findings by Antonelli E *et al.* (2021)^[8], who highlighted pruritus as a common complaint in patients with uncontrolled diabetes due to xerosis and neuropathy. Acanthosis nigricans (14%) in the present study reflects underlying insulin resistance, similar to findings by Coates SJ *et al.* (2021)^[9], who described it as a common marker of metabolic dysfunction in T2DM. Specific diabetic dermatoses such as diabetic dermopathy (11%) were also observed, which parallels the 9-15% prevalence reported by da Rosa Mesquita R *et al.* (2021)^[10]. Rare

manifestations like necrobiosis lipoidica and bullous diabeticorum were infrequent, consistent with their low prevalence in most hospital-based studies.

A significant association was found between glycemic control and cutaneous manifestations (Table 3). The prevalence of skin disorders increased progressively with rising HbA1c levels, reaching 84.6% in patients with HbA1c $>9\%$. Additionally, the mean HbA1c was significantly higher in patients with dermatological involvement. This finding corroborates studies by McMahon DE *et al.* (2021)^[11], who demonstrated a strong correlation between poor glycemic control and increased frequency of skin infections and dermatoses. Poor glycemic control impairs neutrophil function, reduces immunity, and alters microvascular circulation, thereby predisposing patients to infections and other skin disorders.

The duration of diabetes also showed a statistically significant association with dermatological findings (Table 4). Patients with more than 10 years of diabetes had the highest prevalence (85.2%) of cutaneous manifestations. The mean duration of diabetes was significantly greater in patients with skin involvement (8.9 ± 3.8 years) compared to those without (4.8 ± 2.9 years). These observations are consistent with McMahon DE *et al.* (2021)^[12], who reported that longer duration of diabetes increases the likelihood of developing microvascular and cutaneous complications. Prolonged hyperglycemia leads to glycation of collagen, microangiopathy, and neuropathy, which contribute to various dermatological manifestations.

CONCLUSION

The present cross-sectional study demonstrated a high prevalence (73%) of cutaneous manifestations among patients with Type 2 diabetes mellitus. Infectious

dermatoses, particularly fungal infections, were the most common manifestations, followed by xerosis and pruritus. Specific diabetic dermatoses such as acanthosis nigricans and diabetic dermopathy were also observed. A statistically significant association was found between poor glycemic control and increased frequency of dermatological involvement, with higher HbA1c levels correlating with greater prevalence of skin disorders. Furthermore, longer duration of diabetes was significantly associated with the occurrence of cutaneous manifestations. These findings emphasize that skin changes are common and clinically relevant in T2DM patients and may serve as early indicators of poor metabolic control. Routine dermatological evaluation in diabetic patients can aid in early detection, timely management, and prevention of further systemic complications.

LIMITATIONS OF THE STUDY

1. The study was conducted in a single tertiary care center, which may limit the generalizability of the findings to the broader population.
2. The cross-sectional design does not allow establishment of causal relationships between glycemic control and cutaneous manifestations.
3. The sample size of 100 patients, although adequate for preliminary analysis, may not reflect the full spectrum of dermatological manifestations.
4. Some dermatological diagnoses were based primarily on clinical examination, and not all cases underwent confirmatory laboratory or histopathological testing.
5. The study did not assess the impact of treatment modalities, lifestyle factors, or comorbidities on skin manifestations.

REFERENCES

1. Rasid S, Muthupalaniappen L, Jamil A. Prevalence and factors associated with

cutaneous manifestations of type 2 diabetes mellitus. *Clinical Diabetology*. 2020;9(6):461-8.

2. Marzano AV, Cassano N, Genovese G, Moltrasio C, Vena GA. Cutaneous manifestations in patients with COVID-19: a preliminary review of an emerging issue. *British Journal of Dermatology*. 2020 Sep 1;183(3):431-42.
3. Singh H, Kaur H, Singh K, Sen CK. Cutaneous manifestations of COVID-19: a systematic review. *Advances in wound care*. 2021 Feb 1;10(2):51-80.
4. Seirafianpour F, Sodagar S, Pour Mohammad A, Panahi P, Mozafarpour S, Almasi S, Goodarzi A. Cutaneous manifestations and considerations in COVID-19 pandemic: a systematic review. *Dermatologic therapy*. 2020 Nov;33(6):e13986.
5. Farmaki P, Damaskos C, Garmpis N, Garmpi A, Savvanis S, Diamantis E. Complications of the type 2 diabetes mellitus. *Current cardiology reviews*. 2020 Nov 1;16(4):249-51.
6. Zhao Q, Fang X, Pang Z, Zhang B, Liu H, Zhang F. COVID-19 and cutaneous manifestations: a systematic review. *Journal of the European Academy of Dermatology and Venereology*. 2020 Nov;34(11):2505-10.
7. Freeman EE, McMahon DE, Lipoff JB, Rosenbach M, Kovarik C, Desai SR, Harp J, Takeshita J, French LE, Lim HW, Thiers BH. The spectrum of COVID-19-associated dermatologic manifestations: An international registry of 716 patients from 31 countries. *Journal of the American academy of dermatology*. 2020 Oct 1;83(4):1118-29.
8. Antonelli E, Bassotti G, Tramontana M, Hansel K, Stingeni L, Ardizzone S, Genovese G, Marzano AV, Maconi G. Dermatological manifestations in inflammatory bowel diseases. *Journal of clinical medicine*. 2021 Jan 19;10(2):364.
9. Coates SJ, Norton SA. The effects of climate change on infectious diseases with

cutaneous manifestations. International journal of women's dermatology. 2021 Jan 1;7(1):8-16.

10. da Rosa Mesquita R, Francelino Silva Junior LC, Santos Santana FM, Farias de Oliveira T, Campos Alcantara R, Monteiro Arnozo G, Rodrigues da Silva Filho E, Galdino dos Santos AG, Oliveira da Cunha EJ, Salgueiro de Aquino SH, Freire de Souza CD. Clinical manifestations of COVID-19 in the general population: systematic review. Wiener klinische Wochenschrift. 2021 Apr;133(7):377-82.
11. McMahon DE, Amerson E, Rosenbach M, Lipoff JB, Moustafa D, Tyagi A, Desai SR, French LE, Lim HW, Thiers BH, Hruza GJ. Cutaneous reactions reported after Moderna and Pfizer COVID-19 vaccination: a registry-based study of 414 cases. Journal of the American Academy of Dermatology. 2021 Jul 1;85(1):46-55.
12. McMahon DE, Gallman AE, Hruza GJ, Rosenbach M, Lipoff JB, Desai SR, French LE, Lim H, Cyster JG, Fox LP, Fassett MS. Long COVID in the skin: a registry analysis of COVID-19 dermatological duration. The Lancet Infectious Diseases. 2021 Mar 1;21(3):313-4.