

Frequency of cutaneous involvement in diabetes and its association with glycemic control: A cross-sectional study at tertiary care hospital Karachi

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ABSTRACT

Objective: To determine the incidence of skin involvement in diabetic patients, and its correlation with glycemic control in a tertiary care hospital.

Material and Methods: This cross-sectional descriptive study was conducted at the Dr Ruth K.M Pfau Civil Hospital Karachi, Dow University of Health Sciences from 1st April 2026 till 30th July 2026. The patients who had diabetes mellitus were selected by employing non-probability consecutive sampling technique in which 171 patients were recruited. We included patients with diabetes who had a duration of ≥ 5 years and were 20-70 years old. Demographic data, characteristics of diabetes and HbA1C were gathered via a structured proforma. Glycemic control was defined as good glycemic control (defined as an HbA1c $< 7\%$) based on American Diabetes Association guidelines. SPSS version 22 was used for data analysis. A p-value ≤ 0.05 was considered statistically significant.

Results: In 171 diabetic patients, 107 (62.6%) had at least one cutaneous manifestation. The most common findings were xerosis (59, 34.5%), followed by dermatophytosis (51, 29.8%), diabetic dermopathy (43, 25.1%), skin tags (38, 22.2%), and acanthosis nigricans (35, 20.5%). Cutaneous involvement was significantly higher among patients with poor glycemic control compared with good glycemic control (72.4% vs. 41.8%, $p < 0.001$) and among patients with diabetes duration > 10 years compared with those having diabetes duration of 5–10 years (75.9% vs. 51.1%, $p = 0.002$).

Conclusion: Diabetic patients often have cutaneous manifestation that are more noticeable in those who have poor glycemic control or longer duration of diabetes.

Keywords: Diabetes mellitus, Glycemic control, Hyperglycemia, Skin diseases, Xerosis.

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INTRODUCTION

Diabetes mellitus is a chronic metabolic condition which is defined by chronic hyperglycaemia resulting from inadequate production of insulin or insulin resistance or a combination of both. It affects multiple body systems, and is associated with microvascular, macrovascular and dermatological complications. The skin problems are the common, but often overlooked, complications of DM. Including infections, itching, dry skin, diabetic dermopathy, acanthosis nigricans, pigmentary changes and ulcers and other inflammatory or vascular skin changes. These symptoms can adversely impact quality of life and can even be useful clinical indicators of the severity of the disease and glycemic control [1]. Likewise, a different study of patients with type 2 diabetes mellitus revealed different dermatological

abnormalities and their importance as diabetes-related complications [2].

Glycated hemoglobin (HbA1c) level is also an important parameter of glycaemic control and one of the important factors involved in diabetic skin complications. Prolonged hyperglycaemia leads to immune dysfunction, poor wound healing, microvascular changes and increased risk for infection. Furthermore, clinical studies have revealed that skin diseases are strongly associated with the presence of HbA1c, with a strong correlation between these and the presence of the skin disorders; and it is possible that they may be used as indicators of poor metabolic control [3-4]. In addition, clinical studies have shown that the incidence of skin disorders increases with the duration of the diabetes, due to prolonged exposure to hyperglycemia and progressive tissue damage [5].

Skin issues may be a symptom of diabetes or metabolic issues. Data have also shown that skin abnormalities may be useful to clinicians in the detection of unknown diabetes and/or patients requiring further evaluation, and that a variety of dermatological abnormalities including skin, hair and nail changes have been observed, suggesting the systemic nature of diabetes on skin condition [6-8].

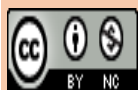
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However, retrospective studies also have been able to confirm that skin complications represent a significant clinical burden in diabetes populations [9-10].

Diabetic skin complications are now well-known, but little is known about the prevalence of diabetic skin complications and its relation with glycemic control in diabetic patients in Karachi city. Therefore, the need of the study was felt to determine the prevalence of skin diseases and to observe its correlation with glycemic control in the diabetic patients of a tertiary care hospital in Karachi. The results could help in the development of earlier identification of high risks patients and aid in the integrated dermatological assessment in routine diabetes care.

MATERIAL AND METHODS

The study was descriptive cross-sectional study with ethical requirements fulfilled and approval of the synopsis from the hospital. Synopsis approval and fulfillment of ethical requirements at the Department of Medicine, Civil Hospital Karachi (CHK). Ethical approval was obtained from the Institutional Review Board (IRB) of Dow University of Health Sciences (DUHS) (IRB Ref No: IRB-4529/DUHS/Approval/2026/164) from 1st April 2026 till 30th July 2026. The study subjects consisted of adult diabetic patients, who came to the inpatient and outpatient Medicine Department, CHK. The sampling technique that was used to recruit participants was a non-probability consecutive sampling technique.

The WHO sample size calculator was used to calculate the sample size. This was based on the reported prevalence of acanthosis nigricans in patients with diabetes (20%) with a 95% confidence level and a 6% margin of error. A sample size of 171 participants was calculated. Sample size calculation was done using the WHO sample size calculation software based on standard epidemiology sample size estimation methods [12].

The study population consisted of patient who had current diagnosis of diabetes mellitus (both type 1 and type 2) with a diabetes duration of at least 5 years and between 20 and 70 years. Those participants who gave written informed consent were recruited. Patients with chronic dermatological diseases that could possibly affect the assessment of diabetic skin disease such as psoriasis and chronic eczema were excluded. Patients with any endocrine disturbance that affects glucose metabolism (including thyroid disorders and Cushing's syndrome), auto-immune diseases affecting the skin

or metabolic abnormalities (such as systemic lupus erythematosus and vasculitis), being prescribed drugs that have known effects on glucose metabolism and/or cause changes in the skin (including systemic corticosteroids and immunosuppressive drugs), and pregnant women were excluded.

Approval of IRB of Dow University of Health Sciences (DUHS) and necessary approvals from the College of Physicians and Surgeons Pakistan (CPSP) were obtained and the data was acquired on a structured proforma. Prior to enrolment all participants provided written informed consent. Clinical parameters were thoroughly assessed and comprised of demographic parameters, anthropometric parameters, diabetes related parameters and dermatological evaluation. The demographic information consisted of age, gender, place of residence, education and socioeconomic status. The anthropometric measurements were height, weight and body mass index (BMI). Information provided was for diabetes and included such things as diabetes type, length of time with diabetes and recent HbA1c measurement.

All dermatological examinations were carried out by a trained dermatologist for uniformity and to minimize observer variation. When it was not possible to confirm a diagnosis of a skin lesion, a senior dermatologist was consulted. The diagnosis of the skin manifestations was mainly clinical, based on predefined diagnostic criteria. The following skin conditions were observed: acanthosis nigricans, skin tags, diabetic dermopathy, rubeosis, dermatophytosis, scabies, eruptive xanthomas, furuncle, carbuncle, cellulitis, diabetic foot ulcer, granuloma annulare, candidiasis, xerosis, vitiligo, lichen planus, common warts, herpes zoster, finger pebbles, scleroderma diabeticorum and diabetic cheiroarthropathy. Dermatological complications occurred in patients and their glycemic control was poor, they were counselled appropriately and referred to the relevant departments for further management. Diabetes mellitus was classified using the American Diabetes Association (ADA) guidelines as having either a random plasma glucose level ≥ 200 mg/dL, a 75-g 2-hour oral glucose tolerance test (OGTT) plasma glucose level ≥ 200 mg/dL, or an HbA1c $\geq 6.5\%$, or a fasting plasma glucose level ≥ 126 mg/dL, in combination with classic symptoms of hyperglycemia. Glycemic control was classified based on the ADA standards: good glycemic control (HbA1C $< 7\%$ without hypoglycemia) [13].

All information gathered were entered and analyzed with the aid of SPSS (Statistical Package for Social Sciences) version 22. The Shapiro–Wilk test was used to check normal distribution of quantitative variables such as age, height, weight, BMI, duration of diabetes and HbA1c. The data variables were described as mean $\pm$ standard deviations (SD) for normally distributed variables and as median (interquartile range) for those that were not normally distributed. Qualitative variables such as gender, place of residence, educational level, socioeconomic status, type of diabetes, diabetic glycaemic control status and presence of cutaneous manifestations were described as frequencies and percentages. Stratification by age, gender, BMI, place of residence, diabetes duration, glycemic control, education level and socioeconomic status were used to control potential effect modifiers. The Chi-square test was used to determine association between categorical variables such as glycemic control status and cutaneous manifestations. Fisher's exact test was used when the expected cell frequencies were ≤ 5 . Statistically significant results were set at p value of ≤ 0.05 .

RESULTS

171 patients with diabetes mellitus were recruited into the study. The average age of the participants was 52.6 years $\pm$ 10.8 years. Male patients were 95 (55.6%) and female patients were 76 (44.4%). Most of the patient had type 2 diabetes mellitus (162, 94.7%) and 9 (5.3%) patients had type 1 diabetes mellitus. The mean age diabetes was diagnosed was 9.2 $\pm$ 4.6 years and the mean HbA1c level was 8.1 $\pm$ 1.6%. Of the 171 patients, 116 (67.8%) had poor glycemic control (HbA1c $\geq 7\%$) and 55 (32.2%) had good glycemic control (HbA1c $< 7\%$) (Table-I).

Of all diabetic patients, 107 patients (62.6%) developed some type of skin involvement. Xerosis was the most common cutaneous manifestation (59, 34.5%), followed by dermatophytosis (51, 29.8%), diabetic dermopathy (43, 25.1%), skin tags (38, 22.2%), and acanthosis nigricans (35, 20.5%). Scleroderma diabeticorum (2, 1.2 %), diabetic cheiroarthropathy (3, 1.8 %) and eruptive xanthomas (4, 2.3 %) and finger pebbles (4, 2.3 %) were the least commonly seen manifestations (Table-II).

There was a significant correlation between glycemic control and cutaneous involvement. 84 (72.4%) patients with poor glycemic control had cutaneous manifestations; while 23 (41.8%) patients with good glycemic control had cutaneous manifestations. The Chi-square test was used to evaluate this association and it was found statistically significant ($p < 0.001$) (Table-III).

Diabetic dermopathy was significantly more common among patients with HbA1c $\geq 7\%$ than with those with HbA1c $< 7\%$ (35, 30.2% vs. 8, 14.5%; $p = 0.04$). There was also a significant association between dermatophytosis and poor glycemic control (41/ 35.3% vs 10/ 18.2%, $p = 0.03$). Diabetic foot ulcer showed higher frequency among patients with HbA1c $\geq 7\%$ (18, 15.5% vs. 3, 5.5%; $p = 0.05$). There was no statistically significant relationship between HbA1c category and any of the other skin manifestations such as acanthosis nigricans, skin tags, candidiasis, and xerosis (Table-IV). (Figure~1) illustrates representative cutaneous manifestations observed in patients with diabetes mellitus, including lichen planus, diabetic foot ulceration, and herpes zoster.

Table-I: Demographic and clinical characteristics of study participants (n=171).

Variables	n (%) / Mean $\pm$ SD
Age (years)	52.6 $\pm$ 10.8
Age group (years)	
20–40	24 (14.0)
41–50	43 (25.1)
51–60	68 (39.8)
61–70	36 (21.1)
Gender	
Male	95 (55.6)
Female	76 (44.4)
Type of diabetes	
Type 1 diabetes mellitus	9 (5.3)
Type 2 diabetes mellitus	162 (94.7)
Duration of diabetes (years)	9.2 $\pm$ 4.6
Duration of diabetes	
5–10 years	92 (53.8)
>10 years	79 (46.2)
HbA1c (%)	8.1 $\pm$ 1.6

Glycemic control status

Good control (HbA1c <7%)	55 (32.2)
Poor control (HbA1c ≥7%)	116 (67.8)

Table-II: Frequency of cutaneous manifestations among diabetic patients (n=171).

Cutaneous Manifestation	n (%)
Any cutaneous involvement	107 (62.6)
Xerosis	59 (34.5)
Dermatophytosis	51 (29.8)
Diabetic dermopathy	43 (25.1)
Skin tags (Acrochordons)	38 (22.2)
Acanthosis nigricans	35 (20.5)
Candidiasis	27 (15.8)
Diabetic foot ulcer	21 (12.3)
Rubeosis	18 (10.5)
Furuncle	17 (9.9)
Cellulitis	15 (8.8)
Herpes zoster	12 (7.0)
Scabies	10 (5.8)
Vitiligo	9 (5.3)
Lichen planus	8 (4.7)
Common warts	7 (4.1)
Carbuncle	6 (3.5)
Granuloma annulare	5 (2.9)
Eruptive xanthomas	4 (2.3)
Finger pebbles	4 (2.3)
Diabetic cheiroarthropathy	3 (1.8)
Scleroderma diabeticorum	2 (1.2)

Table-III: Association of cutaneous manifestations with glycemic control and duration of diabetes.

Variable	Cutaneous involvement Present n (%)	Cutaneous involvement Absent n (%)	Statistical Test	p-value
Glycemic Control			Chi-square test	
Good control (HbA1c <7%)	23 (41.8)	32 (58.2)		<0.001
Poor control (HbA1c ≥7%)	84 (72.4)	32 (27.6)		
Duration of Diabetes			Chi-square test	
5–10 years	47 (51.1)	45 (48.9)		0.002
>10 years	60 (75.9)	19 (24.1)		

Table-IV: Association between HbA1c category and specific cutaneous manifestations.

Cutaneous Manifestation	HbA1c <7% n (%) (n=55)	HbA1c ≥7% n (%) (n=116)	Statistical Test	p-value
Acanthosis nigricans	7 (12.7)	28 (24.1)	Chi-square test	0.08
Skin tags	8 (14.5)	30 (25.9)	Chi-square test	0.10
Diabetic dermopathy	8 (14.5)	35 (30.2)	Chi-square test	0.04
Dermatophytosis	10 (18.2)	41 (35.3)	Chi-square test	0.03
Candidiasis	6 (10.9)	21 (18.1)	Chi-square test	0.24
Diabetic foot ulcer	3 (5.5)	18 (15.5)	Chi-square test	0.05
Xerosis	15 (27.3)	44 (37.9)	Chi-square test	0.18



Figure-I: Representative cutaneous manifestations in patients with diabetes mellitus. (A) Lichen planus presenting as violaceous papules and plaques; (B) diabetic foot ulcer with slough and necrotic tissue over the plantar aspect of the foot; and (C) herpes zoster presenting as grouped vascularized lesions over the trunk.

DISCUSSION

In the present study, the prevalence of cutaneous involvement was investigated in diabetic patients and relationship between cutaneous involvement and glycemic control was evaluated. Sixty-two and a half percent (62.6%) of the patients had at least one skin finding with xerosis, dermatophytosis, diabetic dermopathy, skin tags and acanthosis nigricans being the most common. This information suggests that dermatological complications can be a frequent occurrence in diabetic patients and can be important clinical indicators of metabolic imbalance. Findings regarding skin manifestation in the observed frequency are consistent with other studies. A retrospective study by Vâță *et al.* has revealed a wide spectrum of various skin changes in diabetics such as infectious, inflammatory and metabolic skin changes, underlining the relevance of skin monitoring in the diabetic population from time to time [11]. Chronic pruritus has also been reported in people with diabetes, as has other skin abnormalities, both of which are likely to be a result of the impact of chronic hyperglycaemia on skin integrity and function [12].

Poor glycemic control was also significantly correlated with more severe skin manifestations in the present study, with a higher number of skin symptoms seen in the patients with HbA1c levels $\geq 7\%$. The results of this study are consistent with those reported in previous studies that uncontrolled diabetes is associated with decreased immune system function, compromised immunity to infection, microvascular dysfunction and impaired tissue repair [13]. Moreover, patients who had been diabetic for a longer period of time had a significantly higher prevalence of the skin lesions, suggesting that longer duration of diabetes increases dermatological complications.

Recent publications have stressed that skin changes in the diabetic are more than superficial, and may be indicative of underlying systemic abnormalities. It has been noted that diabetic skin changes can be early signs of disease progression and poor metabolic control and deserve more attention in the routine diabetes follow-up [14-15]. The diverse clinical features, such as xerosis, infection, ulceration, pigmentations and connective tissue disorders highlight the multifaceted association between diabetes and skin [16].

The results of this study also corroborate with studies indicating that early diagnosis and prevention measures may alleviate the burden of skin diabetic

complications. It has been recommended that patient education in skin care, prevention of infections, and glycemic management should be an integral part of comprehensive diabetes care [17]. Recent studies indicate that periodic skin examinations in diabetic patients, especially those with high levels of diabetes duration and glycemic control, can potentially help to identify and treat diabetes complications at an early stage [18-20].

The greatest strength of this study was the standardized dermatological assessment carried out by a trained dermatologist, using pre-defined diagnostic criteria, that enhanced the diagnostic reliability. The study also assessed a wide variety of skin findings and analyzed the association between these findings and glycemic control. There are some restrictions however. There was no ability to establish any causal relationships between poor glycemic control and skin manifestations due to the cross-sectional design of the study. The study was performed in a single tertiary care centre limiting the generalizability. Furthermore, factors like lifestyle, cleanliness, nutrition status and compliance with medicines were not evaluated. Further studies are needed with multicentre designs of a longitudinal nature to determine the temporal association between glycemic control and the development of cutaneous manifestation. Expansion of study size and diversity of populations may enhance generalizability of findings. More studies into the molecular mechanisms by which hyperglycemia leads to dermatologic complications may help in the understanding of the progression of the disease and in the development of prevention measures.

CONCLUSION

Xerosis, dermatophytosis, diabetic dermopathy, skin tags and acanthosis nigricans were the most common dermatological etiologies among patients with diabetes mellitus. Cutaneous involvement was significantly associated with poor glycemic control and longer duration of diabetes. The results show the correlation between metabolic control and dermatological complications among diabetes mellitus patients.

CONFLICT OF INTEREST

None

GRANT SUPPORT & FINANCIAL DISCLOSURE

Declared none

AUTHORS CONTRIBUTION

Kiran Khan: Study design, acquisition of data, manuscript drafting, final approval, responsible for every aspect of the research

Haris Alvi: Concept and study design, supervision, critical review for important intellectual content, final approval, responsible for every aspect of the research

Fareheen Faisal: Dermatological assessment and interpretation of cutaneous findings, critical review for important intellectual content, final approval, responsible for every aspect of the research

Muhammad Rehan: Analysis and interpretation of data, critical review for important intellectual content, final approval, responsible for every aspect of the research

Sana Hussain: Acquisition of data, manuscript drafting or review for important intellectual content, final approval, responsible for every aspect of the research

Mahnoor Mujahid: Acquisition of data, manuscript drafting or review for important intellectual content, final approval, responsible for every aspect of the research

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