
Dermatological manifestations and associated risk factors among diabetic patients in Erbil City: a cross-sectional study

Received: 20/06/2025

Accepted: 06/08/2025

Soleen Muhammed Shuker¹

Bushra Mohammed Ali²

ABSTRACT

Background and objective: Diabetes mellitus is a widespread endocrine disease with a severe impact on health systems worldwide. Skin disorders can be found in about one-third of people with diabetes and frequently occur before diagnosis, playing an important role in the initial recognition of the underlying disease. This study aimed to identify the frequency of dermatological manifestations among diabetic patients and to examine the association between these manifestations and risk factors.

Methods: This descriptive cross-sectional study was carried out among 300 diabetic patients with type I or II diabetes mellitus, aged ≥ 10 years, recruited from Layla Qasim Specialized Diabetic Center in Erbil City, Iraq. Each patient was examined and asked about skin symptoms. Skin manifestations diagnosed by the researcher were recorded directly; for uncertain or intractable findings, photographs were taken and reviewed by a dermatologist to reach an accurate diagnosis. The study was carried out over four months, from the start of February to the end of May 2024.

Results: About two-thirds of patients reported associated skin manifestations. The most common cutaneous manifestations were acrochordons (24.73%), xerosis (22.53%), fungal infections (21.98%), bacterial infections (13.19%), insulin lipodystrophy (12.64%), and generalized pruritus (12.08%).

Conclusion: Skin manifestations are highly prevalent among patients with diabetes, and infectious skin diseases are among the most common. Routine skin screening in diabetes care may facilitate early intervention and improve patient outcomes.

Keywords: Diabetes mellitus, Skin manifestations, Erbil city

¹ Department of Family Medicine, College of Medicine, Hawler Medical University, Erbil, Kurdistan Region, Iraq.

² Department of Family Medicine, College of Medicine, University of Sulaimani, Kurdistan Region, Iraq.

Correspondence: Soleen Muhammed Shuker, soleenmshuker@gmail.com

Copyright © The Author(s) 2026. Open Access. This work is licensed under a [Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License](https://creativecommons.org/licenses/by-nc-sa/4.0/).

INTRODUCTION

Diabetes mellitus (DM) is a chronic illness affecting multiple systems. Diabetes is becoming increasingly prevalent, particularly in recently urbanized and emerging countries (1). Diabetes mellitus, as defined by the World Health Organization (WHO), is a metabolic illness of multiple etiologies characterized by persistent hyperglycemia and disturbances in lipid, protein, and carbohydrate metabolism caused by a disruption in insulin action, insulin secretion, or both (2). Diabetic hyperglycemia causes the formation of advanced glycation end products (AGEPs), which are responsible for diabetes complications such as macrovascular and microvascular problems (3, 4). The skin serves as a window into the body's internal state, and skin symptoms can often aid in the detection of internal disorders; cutaneous symptoms are therefore important for early diagnosis and illness management. Globally, the prevalence of skin disease in diabetes mellitus ranges from 51.1% to 97% (5). Cutaneous signs of diabetes may vary depending on how long the condition has been present and how well it is controlled. Almost all DM patients develop skin abnormalities as a result of hyperglycemia's long-term impact on microcirculation and skin collagen. In addition, anti-diabetic medications can cause cutaneous side effects, and diabetes-related skin lesions may serve as an entry point for microorganisms, leading to secondary infections (6). Although cutaneous manifestations often appear after the development of DM, they may also be the first presenting sign or even precede the diagnosis of diabetes by years; skin manifestations may therefore help in the early diagnosis of diabetes (7). The conventional way of measuring long-term glycemic control is to measure glycated hemoglobin (HbA1c). The pattern of cutaneous symptoms may vary depending on glycemic control,

as determined by HbA1c, and depending on the duration of the disease (8). Dermatological symptoms of diabetes mellitus can be divided into four categories: skin lesions closely connected with diabetes, skin lesions of infectious etiology, diabetes sequelae, and lesions related to diabetic treatment. Understanding the dermatological symptoms of diabetes mellitus may therefore help improve the overall prognosis of the condition through early detection and treatment (9).

Diabetes is a chronic multisystem disorder. Cutaneous manifestations can be the presenting sign of DM, or a sequela of the disease (10); a study of cutaneous manifestations in diabetic patients is therefore of considerable importance, and a dermatologist may be the first medical professional to identify latent diabetes in a patient. The aim of this study is to investigate the prevalence and risk factors of dermatological manifestations among patients with diabetes mellitus, with the main objectives of identifying the frequency of dermatological manifestations among diabetic patients and examining the association between these manifestations and risk factors.

METHODS

Study Setting

This cross-sectional study was carried out over a four-month period, from 1 February to 1 June 2024. Data were collected during regular working hours (four hours/day, three days/week). The study included a convenience sample of 300 diabetic patients with type I or II DM, recruited from Layla Qasim Specialized Diabetic Center in Erbil City, Iraq. Patients aged ≥ 10 years, of both genders, were included; patients with malignancy or severe disease status were excluded. Data were collected through a structured questionnaire. Patients were interviewed directly, and anthropometric measurements (weight, height, and BMI) were

taken for each patient. The questionnaire covered sociodemographic characteristics, diabetic history, drug history, laboratory data, and dermatological manifestations. A pilot study was conducted on 20 diabetic patients to assess the practicality, clarity, and time required to complete the questionnaire (about 10 minutes); these cases were excluded from the main study, and no modifications were needed afterward.

Statistical Analysis

Data were analyzed using SPSS (Statistical Package for Social Sciences) version 25 (IBM Corp., Armonk, NY, USA). Collected data were revised, coded, tabulated, and entered into the software, and analyzed according to the type of data obtained for each parameter. Descriptive statistics included mean, standard deviation ($\pm$ SD), median, and range (minimum-maximum) for numerical data, and frequency and percentage for categorical data. The

Chi-square test and Fisher's exact test were used to examine associations between variables. A p-value < 0.05 was considered statistically significant.

Ethical Considerations

Formal approval was obtained from the Scientific Committee of the Arab Board. Official permission was then obtained from the Erbil Directorate of Health and from Layla Qasim Diabetic Health Center. Verbal consent was obtained from all patients after explaining the aim of the study, and only those willing to participate were included.

RESULTS

The study included 300 diabetic patients. The most common age group was 40-59 years (38%), 41.7% had normal weight, 67.7% were female, 72.3% resided inside the city, 69% were married, and 55% were of middle socioeconomic status, as shown in Table 1.

Table 1. Demographic data of included patients

Variable	Category	No.	%
Age	<20 years	33	11.0
	20-39 years	72	24.0
	40-59 years	114	38.0
	≥ 60 years	81	27.0
BMI	Normal weight	125	41.7
	Overweight	107	35.7
	Obese	68	22.6
Gender	Male	97	32.3
	Female	203	67.7
Residence	Inside city	217	72.3
	Outside city	83	27.7

Variable	Category	No.	%
Marital status	Married	207	69.0
	Single	76	25.3
	Divorced	8	2.7
	Widowed	9	3.0
Education	Primary	47	15.7
	Intermediate	38	12.7
	Secondary	53	17.7
	College	41	13.7
	Postgraduate	8	2.7
	Illiterate	60	20.0
	Read & write	53	17.7
Socioeconomic status	Low	62	20.7
	Moderate	165	55.0
	High	73	24.3
Occupation	Unemployed	49	16.3
	Employed	38	12.7
	Free work	23	7.7
	Housewife	122	40.7
	Student	47	15.7
	Non-manual work	13	4.3
	Skilled manual work	8	2.7
Smoking	Smoker	60	20.0
	Non-smoker	147	49.0
	Ex-smoker	5	1.7
	Second-hand smoke	88	29.3

Family history of DM was present in 58.3%; diabetic duration was mostly < 5 years (37.3%), and 66% of patients had type 2 DM. The majority of patients (92.3%) were on regular diabetic medications; insulin injection alone was used by 37.3% and tablet therapy only by 43%, as shown in Table 2.

Table 2. Diabetic status of included patient

Variable	Category	No.	%
Family history of DM	Yes	175	58.3
	No	125	41.7
Diabetic duration	<5 years	112	37.3
	5-9 years	55	18.3
	10-14 years	65	21.7
	≥15 years	68	22.7
DM type	Type I	102	34.0
	Type II	198	66.0
Regular medications	Yes	277	92.3
	No	23	7.7
Medication type	Single therapy (tablet)	64	21.3
	Dual therapy (2 tablets)	65	21.7
	Dual therapy (tablet+insulin)	13	4.3
	Triple therapy (2 tablets+insulin)	23	7.7
	Insulin alone	112	37.3
Other medications	Yes	127	42.3
	No	173	57.7
Corticosteroid use	Yes	21	7.0
	No	279	93.0
Associated diseases	None	150	50.0
	Hypertension	69	23.0
	Ischemic heart disease	15	5.0
	Dyslipidemia	31	10.3
	Thyroid disorders	23	7.7
	Other	12	4.0

Skin manifestations were present in 60.7% of patients, most commonly with duration <12 months (39%) or 12-24 months (31.9%). The most common cutaneous manifestations were fungal infections (21.98%), acrochordons (24.73%), xerosis (22.53%), bacterial infections (13.19%), insulin lipodystrophy (12.64%), and generalized pruritus (12.08%), as shown in Table 3.

Table 3. Dermatological manifestations in included patients

Category	Manifestation	No. (%)
Presence of skin manifestations	Yes	182 (60.7)
	No	118 (39.3)
Duration	<12 months	71 (39.0)
	12-24 months	58 (31.9)
	>24 months	53 (29.1)
Cutaneous infections (n=182)	Fungal infections	40 (21.98)
	Bacterial infections	24 (13.19)
	Viral infections	5 (2.75)
	Parasitic infestations	4 (2.19)
Neuropathic/ischemic disease	Diabetic foot ulcer	12 (6.59)
Microangiopathy-associated	Diabetic dermopathy	14 (7.69)
	Granuloma annulare	3 (1.65)
Metabolic skin disease	Xanthelasma palpebrarum	11 (6.04)
Commonly associated with DM	Acrochordons	45 (24.73)
	Cherry angiomas	15 (8.24)
	Psoriasis	8 (4.39)
	Generalized pruritus	22 (12.08)
	Acanthosis nigricans	14 (7.69)
	Lichen planus	2 (1.10)
	Vitiligo	10 (5.49)
	Diagonal ear lobe crease	4 (2.19)
	Terry's nails	9 (4.95)
	Pigmented purpuric dermatoses	1 (0.55)
	Perforating dermatoses	1 (0.55)
	Localized cutaneous amyloidosis	1 (0.55)
	Xerosis	41 (22.53)
Treatment-related	Insulin lipodystrophy	23 (12.64)
Other manifestations		12 (6.59)

Percentages calculated of the 182 patients with skin manifestations; categories are not mutually exclusive, so totals across rows exceed 182.

Skin manifestation frequency was 29% in type 1 DM and 71% in type 2 DM (Figure 1).

There was no statistically significant association between DM control status and the presence of skin manifestations (Table 4). Skin manifestations were

present in 55.6% of the controlled DM group and 62% of the uncontrolled DM group ($p = 0.335$).

Of patients with skin manifestations, 19% had controlled DM and 81% had uncontrolled DM (Figure 2).

Table 4. Skin manifestations by DM control status

DM status	Present	Absent	p
Controlled	55.6%	44.4%	0.335
Uncontrolled	62.0%	38.0%	

Chi-square test.

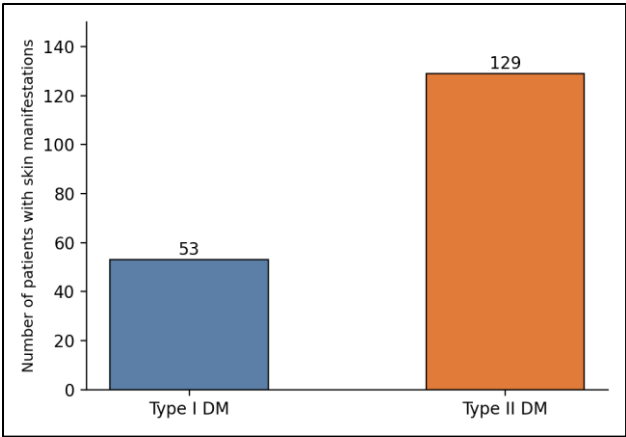


Figure 1. Skin manifestations frequency in type 1 and type 2 DM

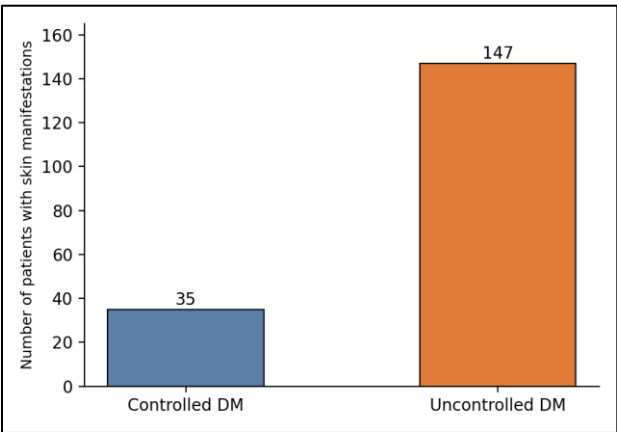


Figure 2. Skin manifestations frequency by diabetic control status

No significant difference was found between duration of DM and duration of skin manifestations (Table 5).

Significant associations were found between the presence of skin manifestations and patients' age, BMI, and occupation (Table 6).

Table 5. Association between duration of DM and duration of skin manifestations

Diabetic duration	<12 mo (%)	12-24 mo (%)	>24 mo (%)	p
<5 years	43.3	30.0	26.7	0.980 [NS]
5-9 years	36.4	33.3	30.3	
10-14 years	39.5	28.9	31.6	
≥15 years	35.3	35.3	29.4	

Chi-square test. NS = not significant.

Table 6. Association between skin manifestations and sociodemographic factors

Variable	Category	Present No. (%)	Absent No. (%)	p
Age	<20y	12 (6.6)	21 (17.8)	0.019 [S]
	20-39y	43 (23.6)	29 (24.6)	
	40-59y	73 (40.1)	41 (34.7)	
	≥60y	54 (29.7)	27 (22.9)	
BMI	Normal	64 (35.2)	61 (51.7)	0.011 [S]
	Overweight	69 (37.9)	38 (32.2)	
	Obese	49 (26.9)	19 (16.1)	
Gender	Male	52 (28.6)	45 (38.1)	0.082 [NS]
	Female	130 (71.4)	73 (61.9)	
Residence	Inside city	139 (76.4)	78 (66.1)	0.055 [NS]

Variable	Category	Present No. (%)	Absent No. (%)	p
Marital status	Outside city	43 (23.6)	40 (33.9)	0.064 [NS]
	Married	136 (74.7)	71 (60.2)	
	Single	37 (20.3)	39 (33.1)	
	Divorced	4 (2.2)	4 (3.4)	
	Widowed	5 (2.7)	4 (3.4)	
Occupation	Unemployed	37 (20.4)	12 (10.2)	0.009 [S]
	Employed	24 (13.2)	14 (11.9)	
	Free work	11 (6.0)	12 (10.2)	
	Housewife	79 (43.4)	43 (36.4)	
	Student	19 (10.4)	28 (23.7)	
	Non-manual	6 (3.3)	7 (5.9)	
	Skilled manual	6 (3.3)	2 (1.7)	
Smoking	Smoker	38 (20.9)	22 (18.6)	0.663 [NS]
	Non-smoker	85 (46.7)	62 (52.5)	
	Ex-smoker	1 (0.5)	1 (0.8)	
	2nd-hand smoke	55 (30.2)	33 (28.0)	

Chi-square test. S = significant; NS = not significant. Educational level and socioeconomic status were also tested and were not significant ($p=0.478$ and $p=0.871$, respectively).

Significant associations were also found between the presence of skin manifestations and patients'

diabetic duration, other medications used, and associated diseases (Table 7).

Table 7. Association between skin manifestations and diabetic-related factors

Variable	Category	Present (%)	Absent (%)	p
Diabetic duration	<5y	60 (33.0)	52 (44.1)	0.036 [S]
	5-9y	33 (18.1)	22 (18.6)	
	10-14y	38 (20.9)	27 (22.9)	
	≥15y	51 (28.0)	17 (14.4)	
Family history of DM	Yes	100 (55.0)	75 (63.6)	0.139 [NS]
	No	82 (45.0)	43 (36.4)	
Regular medications	Yes	165 (90.7)	112 (95.0)	0.102 [NS]
	No	21 (9.3)	2 (5.0)	
Other medications	Yes	94 (51.6)	33 (28.0)	0.001 [S]
	No	88 (48.4)	85 (72.0)	
Corticosteroid use	Yes	15 (8.2)	6 (5.1)	0.408 [NS]
	No	167 (91.8)	112 (94.9)	
Associated diseases	None	50 (27.5)	19 (16.1)	0.001 [S]
	Hypertension	7 (3.8)	8 (6.8)	
	Ischemic heart disease	26 (14.3)	5 (4.2)	
	Dyslipidemia	18 (9.9)	5 (4.2)	
	Thyroid disorders	5 (2.7)	7 (5.9)	
	Other	76 (41.8)	74 (62.7)	

Chi-square test. S = significant; NS = not significant. Type of diabetic medications was not significantly associated (p=0.427).

DISCUSSION

The current study included 300 diabetic patients, most commonly aged 40-59 years (38%), followed by ≥ 60 years (27%) and 20-39 years (24%). Similarly, Umadevi et al. (2020) (11) in India reported peak prevalence (32%) in the 50-59 age group. A different age distribution was reported by Garg & Chandra (2021) (13) in India, with 59% of patients aged 40-59 years, 31% aged ≥ 60 years, and 10% aged 20-39 years; differing sociodemographic characteristics could explain this discrepancy.

The majority of patients in the current study were of normal weight (41.7%), overweight (35.7%), or obese (22.6%). By contrast, Barman et al. (2024) (14) in India reported that 53% of the study population were obese, and Ahmed et al. (2022) (15) in Egypt reported that 51.4% of patients were obese and only 10.3% were of normal weight. These differences may be attributable to different numbers of included patients and different age and gender distributions across studies. About two-thirds (67.7%) of patients in the current study were female. Similarly, Fahad et al. (2024) (16) in Pakistan reported 62.5% of included patients were female, and Văță et al. (2023) (17) in Romania reported 58% female patients. By contrast, Garg & Chandra (2021) (13) and Barman et al. (2024) (14) reported 45% and 47.5% female patients, respectively, which may reflect different sociodemographic characteristics across settings.

Mean duration of diabetes was 9.14 ± 7.7 years: 37.3% (< 5 years), 22.7% (≥ 15 years), 21.7% (10-14 years), and 18.3% (5-9 years). Bose & Kumar (2020) (18) reported that 72.5% of patients had diabetes for ≤ 5 years and 27.5% for ≥ 5 years, while Umadevi et al. (2020) (11) in India reported 48% with 1-5 years' duration, 27% with 6-10 years, and 18% with more than 10 years. Family history of DM was present in 58.3% of patients in the current study.

In line with this, Barman et al. (2024) (14) reported 37% of patients with a family history of DM, and Umadevi et al. (2020) (11) reported 44%. The main type of DM was type II (66%), consistent with Garg & Chandra (2021) (13) (99% type II), Bose & Kumar (2020) (18) (96.7% type II), and Umadevi et al. (2020) (11) (96% type II); as previously reported, type II DM accounts for the majority of diabetic patients worldwide.

The vast majority of patients (92.3%) were on regular diabetic medications: 43% on oral hypoglycemics, 37.3% on insulin therapy alone, and 12% on both. In agreement with this, Fahad et al. (2024) (16) in Pakistan reported 61.5% on oral hypoglycemics, 30% on insulin alone, and 7.5% on both — consistent with the fact that most patients in both studies had type II rather than type I DM. The most common associated complications in the current study were hypertension (23%), dyslipidemia (10.3%), and thyroid disorders (7.7%). In agreement with this, Barman et al. (2024) (14) in India observed that the majority (58%) of the study population had a history of hypertension, followed by dyslipidemia (30%), and Umadevi et al. (2020) (11) reported that 55% had an associated systemic illness, most commonly hypertension (48%). The effect of DM on vascular atherosclerosis is well documented, and atherosclerosis is a major precipitating factor for hypertension.

About two-thirds (60.7%) of patients in the current study reported associated skin manifestations. Similarly, Fahad et al. (2024) (16) in Pakistan reported that 57.5% of diabetic patients had associated skin manifestations, and Ahmed et al. (2022) (15) in Egypt reported 62.8%. By contrast, a higher frequency was reported by Garg & Chandra (2021) (13) in India (99%), which may be attributable to the higher proportion of type II DM in that study. The most common cutaneous

manifestations in the current study were fungal infections (21.98%), acrochordons (24.73%), xerosis (22.53%), bacterial infections (13.19%), insulin lipodystrophy (12.64%), and generalized pruritus (12.08%). In the same context, Garg & Chandra (2021) (13) in India reported that the most common cutaneous manifestations were fungal infections (50%), skin tags (33%), cherry angioma (21%), and bacterial infections and xerosis (19%). Barman et al. (2024) (14) in India reported that fungal infection was the most common infection overall, affecting about 77% of the study sample, followed by bacterial infection (25%). Vâță et al. (2023) (17) in Romania reported that the most common skin manifestations were fungal infections (78.6%), xerosis (42.7%), and bacterial infections (33.9%). Ahmed et al. (2022) (15) in Egypt reported cutaneous infections (27%), acrochordons (19.2%), pruritus (18.2%), xerosis (16.6%), and acanthosis nigricans (16.2%) as the most common manifestations. Diabetic dermopathy was identified in 7.69% of patients in the current study, a lower proportion than reported by a regional study from Sulaimaniyah, Kurdistan, which found a substantially higher prevalence of diabetic dermopathy, correlated with poorer glycemic control (12). Bose & Kumar (2020) (18) in India reported that infective dermatoses were observed in 60% of patients, with cutaneous fungal infections in 38.3% and bacterial infections in 21.7%. Umadevi et al. (2020) (11) in India reported that cutaneous infections were the most commonly observed dermatoses (51%), most often fungal (38%), followed by bacterial (11%). The effect of DM on infective dermatoses can be explained by multiple factors, including impaired immune response and neuropathy, leading to diminished sensation in the extremities. High blood sugar levels also create a favorable environment for pathogens, facilitating infection (13).

In the current study, type II DM was more strongly associated with skin manifestations than type I, in agreement with Garg & Chandra (2021) (13) in India. Type II DM is usually associated with a state of systemic inflammation and immune dysregulation that is more prominent than in type I DM, so associated comorbidities are more common with type II DM (16). In the current study, no significant difference was detected between control of DM and presence of skin manifestations. In contrast, Fahad et al. (2024) (16) in Pakistan reported a significant association between DM control and presence of skin manifestations, which could be explained by a higher proportion of uncontrolled diabetic patients in that study. Significant associations were also found between presence of skin manifestations and patients' age, BMI, occupation, DM duration, other medications used, and associated diseases. In agreement with this, Ahmed et al. (2022) (15) in Egypt reported that longer duration of diabetes, poorly controlled DM, and obesity were significantly associated with skin manifestations.

LIMITATIONS OF THE STUDY

The sample size was selected based on convenience due to a limited duration for data collection, which may affect the representativeness of the findings. The study did not include a healthy non-diabetic control group, limiting comparisons between diabetic and non-diabetic populations. The relatively small number of participants may reduce the generalizability of the results. The data collection period was limited to four months, which could introduce seasonal variability bias, as some dermatological manifestations may vary by season.

CONCLUSION

In the current study, about two-thirds of patients reported associated skin manifestations. The most common cutaneous manifestations were fungal

infections, acrochordons, xerosis, bacterial infections, insulin lipodystrophy, and generalized pruritus. Compared with type I, type II diabetes was more frequently linked to cutaneous symptoms. Significant associations were also found between the presence of skin manifestations and patients' age, BMI, occupation, DM duration, other medications used, and associated diseases.

COMPETING INTEREST

The authors declare that they have no competing interests.

REFERENCES

1. Bloomgarden Z, Handelsman Y. Diabetes epidemiology and its implications. In: Jenkins AJ, Toth PP, editors. *Lipoproteins in Diabetes Mellitus*. Cham: Humana; 2023. P. 881-90. https://doi.org/10.1007/978-3-031-26681-2_31
2. Gregg EW, Paterno E, Karter AJ, Mehta R, Huang ES, White M, et al. Use of real-world data in population science to improve the prevention and care of diabetes-related outcomes. *Diabetes Care*. 2023;46(7):1316-26. <https://doi.org/10.2337/dc22-1438>
3. Ruze R, Liu T, Zou X, Song J, Chen Y, Xu R, et al. Obesity and type 2 diabetes mellitus: connections in epidemiology, pathogenesis, and treatments. *Front Endocrinol (Lausanne)*. 2023;14:1161521. <https://doi.org/10.3389/fendo.2023.1161521>
4. Taha NA, Abdoulrahman KK. Assessment of the status of advanced glycation end products, oxidative stress, and other biomarker parameters in the sera of diabetic patients in Erbil city. *Zanco J Med Sci*. 2026;30(1):45-58. <https://doi.org/10.15218/zjms.2026.004>
5. Dremine VV, Zhrebtskov EA, Popov AP, Meglinski IV, Bykov AV. Hyperspectral imaging of diabetes mellitus skin complications. In: *Biomedical Photonics for Diabetes Research*. 2022. P. 177-95. <https://doi.org/10.1201/9781003112099-8>
6. Labib A, Rosen J, Yosipovitch G. Skin manifestations of diabetes mellitus. In: Feingold KR, Anawalt B, Boyce A, et al., editors. *Endotext* [Internet]. South Dartmouth (MA): MDText.com; 2022. P. 1-30. <https://www.ncbi.nlm.nih.gov/books/NBK278939/>
7. Henry D, Singh A. A study of pattern of cutaneous manifestations in patients with diabetes mellitus. *J Pak Assoc Dermatol*. 2020;30(1):161-6. <https://doi.org/10.66344/jpad.v30i1.1302>
8. Roslind S, Muhammed K, Kumar KS. Cutaneous manifestations in patients with type 2 diabetes mellitus and normal controls. *J Skin Sex Transm Dis*. 2020;2(1):26-30. https://doi.org/10.25259/JSSTD_47_2019
9. Salari N, Hosseini-Far A, Hosseini-Far M, Kavoussi H, Jalali R, Vaisi-Raygani A, et al. Evaluation of skin lesions in diabetic patients: a systematic review and meta-analysis. *J Diabetes Metab Disord*. 2020;19:1909-16. <https://doi.org/10.1007/s40200-020-00629-7>
10. Lovic D, Piperidou A, Zografou I, Grassos H, Pittaras A, Manolis A. The growing epidemic of diabetes mellitus. *Curr Vasc Pharmacol*. 2020;18(2):104-9. <https://doi.org/10.2174/1570161117666190405165911>
11. Umadevi V, Kilaru KR, Rasool A, Saritha N. A clinical study of cutaneous manifestations in diabetes mellitus. *Int J Dermatol Venereol Lepr Sci*. 2020;3(2):88-92. <https://doi.org/10.33545/26649411.2020.v3.i2b.49>

12. Elethawi AMD. Diabetic dermopathy and poor glycemic control among diabetic patients in Sulaimaniyah, Kurdistan, Iraq. *Adv Med J*. 2022;7(1):123-8.
<https://doi.org/10.56056/amj.2022.168>
13. Garg P, Chandra M. Cutaneous manifestation of diabetes mellitus. *J Adv Med Dent Sci Res*. 2021;9(5):100-5.
<https://doi.org/10.21276/jamdsr>
14. Barman S, Achar A, Sengupta N, Chowdhury J, Bhakta A. Cutaneous manifestations of diabetes mellitus in a tertiary care hospital in Eastern India: a cross-sectional study. *J Dermatol Dermatol Surg*. 2024;28(1):29-32.
https://doi.org/10.4103/jdds.ijds_47_23
15. Ahmed AS, Khodair H, Eldahshan RM, Al-Adl AS. Prevalence of cutaneous disorders among diabetic patients in Damietta Governorate: a cross-sectional study. *Int J Med Arts*. 2022;4(2):2112-7.
<https://doi.org/10.21608/ijma.2021.100826.1301>
16. Fahad R, Soban M, Qasim SF, Aziz Z, Mughal F, Azim F. Frequency of skin disorders in type 2 diabetes mellitus: a cross-sectional study. *J Liaquat Univ Med Health Sci*. 2024;23(2):155-9.
<http://ojs.lumhs.edu.pk/index.php/jlumhs/article/view/1281>
17. Vâță D, Stanciu DE, Temelie-Olinici D, Porumb-Andrese E, Tarcău BM, Grecu VB, et al. Cutaneous manifestations associated with diabetes mellitus — a retrospective study. *Diseases*. 2023;11(3):106.
<https://doi.org/10.3390/diseases11030106>
18. Bose R, Kumar S. Dermatological manifestations in diabetes mellitus. *IP Indian J Clin Exp Dermatol*. 2020;6(2):136-44.
<https://doi.org/10.18231/j.ijced.2020.028>