Original Article

Frequency of Skin Disorders in Type 2 Diabetes Mellitus: A Cross-Sectional Study

Razeen Fahad[1], Madiha Soban[1], Saeeda Fouzia Qasim[2], Zubia Aziz[3], Faizah Mughal[4], Fahad Azim[5]

ABSTRACT

OBJECTIVE: To determine the frequency of different Skin Manifestations in people with type II Diabetes Mellitus who visit a tertiary care unit in Karachi, Pakistan.

METHODOLOGY: This cross-sectional study was conducted at Liaquat College of Medical & Dentistry & Darul-Sehat Hospital Karachi from July to Nov 2023. A total of 200 patients with Type II Diabetes Mellitus, attending endocrine & dermatology OPD, were enrolled in this study by using consecutive, non -probability sampling techniques. Demographic parameters were noted. Data was analyzed by SPSS version 20.

RESULTS: Two hundred type II Diabetes Mellitus patients (125 Females and 75 Males) were enrolled in the current study. The mean Age of the patients was 49.62± 10 years, and the mean duration of diabetes was between 6.74± 5.55 years. 115 out of 200 (57.5%) patients showed some skin manifestations. The skin manifestations observed were: Infections (bacterial/fungal) (17.38%), Ulcer & gangrene of foot (6.08%), Pruritis (13.33%), Diabetic dermopathy (10.42%), Foot swelling (7.81), Thick and scaly skin (8.68%), Pigmentation including shin spots (7.81%), Cellulitis (6.07%), Acanthosis nigricans (5.2%), Yellow nails (5.2%), Skin tags(3.46%), Psoriasis (3.46%).

CONCLUSION: Participants having Diabetes Mellitus type II are found to have a high frequency of skin manifestations (57.5%). The ratio for females was higher than for males. The majority of participants had only one skin manifestation. A noteworthy association was found between higher HbA1c levels (8.1 to 14%) & the presence of cutaneous manifestations.

KEYWORDS: Diabetes Mellitus type II, Skin manifestations, Skin Infections (bacterial /fungal).

INTRODUCTION

Diabetes Mellitus is a metabolic condition characterized by hyperglycemia, which results from either defective or insufficient insulin production or the action of insulin hormones secreted by the pancreas[1]. The persistent and uncontrolled hyperglycemia in diabetes mellitus is associated with complications involving eyes, kidneys, heart, skin, nervous system and blood vessels[2]. The International Diabetes Federation (IDF) estimates that 366 million individuals around the world had diabetes mellitus in 2011, and this figure is expected to rise to 552 million by 2030[3].

There is an extensive ongoing study into the complicated, multifaceted pathophysiology of diabetes and its consequences. Diabetes individuals with 30% to 79% cutaneous signs of the condition have been described[5]. There is a wide range of DM-related cutaneous illnesses, from mild to potentially fatal diseases. Even benign cutaneous abnormalities are significant because they may indicate underlying DM in patients who have not yet been diagnosed or signify poorly managed illness in those already diagnosed with the condition[6].

One of the main characteristics of diabetes is hyperglycemia, which immediately impacts the function of keratinocytes and fibroblasts[7]. Furthermore, hyperglycemia increases protein, lipid, and nucleic acid (non-enzymatic) glycation, which promotes the production of advanced glycation end products[8]. These products alter the function and structure of the skin cells and affect the development of vascular problems. Patients are more likely to contract infections and have slower wound healing when they have vascular disease and diabetes-related immune suppression[9]. Because of insulin resistance, several diabetic skin symptoms may appear before diagnosis[10].

Manifestations of DM vary widely based on the disease's chronicity and severity of the disease[11]. All individuals with diabetes mellitus eventually have abnormal skin conditions because blood glucose levels have a long-term effect on blood flow and skin collagen. Medications used to treat diabetes might also have adverse skin side effects. For example, Sulfonylureas are the anti-diabetic medications that

[1]*Department of Biochemistry, Karachi Institute of Medical Sciences, Karachi, Sindh-Pakistan*
[2]*Department of Endocrinology, Liaquat College of Medicine and Dentistry, Karachi, Sindh-Pakistan*
[3]*Department of Biochemistry, Liaquat College of Medicine and Dentistry, Karachi, Sindh-Pakistan*
[4]*Department of Biochemistry, Fazaiya Ruth Pfau Medical College, Base Faisal, Karachi, Sindh-Pakistan*
[5]*Ziauddin University, Karachi, Sindh-Pakistan*
Correspondence: *babarzubia@gmail.com*
doi: 10.22442/jlumhs.2024.01095
Received: 06-12-2023 Revised: 30-04-2024
Accepted: 17-05-2024

most commonly result in skin eruptions. Additionally, skin sores associated with diabetes may be a gateway for secondary infections and microbes[12].

Early identification of cutaneous symptoms in individuals with diabetes or pre-diabetes is crucial because it may lead to an appropriate metabolic evaluation, prompt referral, and timely treatment, improving the prognosis of diabetic patients and reducing the long-term impact of diabetes secondary complications.

The rationale of this study involves investigating the frequency of skin disorders in type II diabetic patients, their early diagnosis to prevent complications, and the overall impact on the quality of life of a diabetic individual.

METHODOLOGY

This cross-sectional study was conducted at Liaquat College of Medical & Dentistry & Darul-Sehat Hospital, Karachi, from July to November 2023. The study was carried out after approval by the Institutional Review Board, Liaquat College of Medicine & Dentistry (Ref No. IRB/M-000065/23). A total of 200 Patients with type 2 diabetes were included in the study, out of which 115 showed some skin manifestations. Individuals diagnosed with Type 2 Diabetes Mellitus based on physician diagnosis, medical records, or documented use of anti-diabetic medications. Patients with stable diabetes management and no recent hospitalizations within the past three months were included in the study. Patients with secondary skin changes as a result of pregnancy, other systemic diseases or who have undergone surgeries or dermatological treatments within the past three months were excluded. Also, patients with type 1 diabetes mellitus, patients with psychiatric disorders or immunocompromised diseases (AIDS, chemotherapy) were excluded from the study. All of the participants gave informed consent. Demographic data from all registered subjects were also recorded. Enrolled patients provided their medical histories, including the duration of diabetes and mode of treatment.

After an extensive general examination of the skin, the clinical diagnosis of the dermatological manifestations was established. To assess how well the diabetes was being controlled, estimates of FBS, RBS, and glycosylated Hemoglobin (HbA1c) were obtained for each patient. SPSS (Social Science Statistical Package) version 20 was used to generate, tabulate, and analyze the data. Quantitative data such as Age, duration of diabetes, fasting blood glucose and random blood glucose levels were represented by the mean and standard deviation. Frequencies and Percentages were employed to express descriptive data, such as different skin conditions. The relationship between Gender and glycemic control and other skin manifestations was identified using the chi-square test. A P-value of less than 0.05 is regarded as significant.

RESULTS

Two hundred diagnosed cases of type II Diabetes Mellitus of both genders participated in this study. The mean Age of the participants was found to be 49.62± 10 years. One hundred twenty-five subjects (62.51%) were females. The majority of them had diabetes for < 5 years (112, 56%), while (34, 17%) had diabetes for >10 years. The majority of participants (123, 61.51%) took Oral hypoglycemic, (60, 30%) took Insulin, and (15, 7.50%) used a combination of Insulin and hypoglycemic agents **(Table I).**

Table I: Anthropometric Variables (n=200)

Variables	Frequency (%)
Total number of subjects (n)	200
Mean Height (m)	1.6+0.40
Mean Weight (Kgs)	58.7+10.51
Mean BMI (Kg/m2)	27.9+8.40
Mean Age (yrs.)	49.62 ± 10
Gender	
Male	75(37.50%)
Female	125(62.51%)
Mean Duration of Diabetes(yrs)	6.74 ± 5.55 years
< 5 years	112(56%)
5-9 years	54(27%)
>10 years	34(17%)
Treatment of Diabetes	
With Oral Hypoglycemic agents	123(61.51%)
With Insulin	60(30%)
With Both Oral therapy & Insulin	15(7.50%)

The mean fasting blood sugar (FBS) was 129.78±32.76 mg/dl, the mean random blood sugar (RBS) was 224±45.56, and the Mean HbA1c was 7.71 ± 1.23 of the participants. The HbA1c of most subjects (166, 83 %) was between 5-8%, while about (34, 17%) had HbA1c between 8.1 to 14%.

One hundred fifteen participants in our study presented with skin manifestations, including 60 females and 55 males. The results indicated that more bacterial and fungal infections were observed in females (9.56%) than in males (7.82%). Ulcer and gangrene of the foot were reported in 2.60% of males and 1.7% of females. Pruritus, characterized by itching, affected 6.08% of males and 6.95% of females respectively. Diabetic dermopathy was noted in 4.34% of males and 6.08% of females. Additionally, foot swelling was observed in 3.47% of males and 4.34% of females. Thick and scaly skin was reported in 4.34% of males and females. Pigmentation issues, including shin spots, were found in 3.47% of males and 4.34% of females. Cellulitis, a bacterial skin infection, affected 4.34% of males and 1.73% of females. Acanthosis nigricans was seen in 2.60% of

both males and females. Yellow nails and skin tags were observed in 2.60% of both genders. Lastly, psoriasis was reported in 0.86% of males and 2.60% of females **(Table II).**

Table II: Number& percentage of participants with Skin Manifestations based on Gender

Number of participants with Skin Manifestations (n=115)	Males (n=55)	Females (n=60)
Infections (bacterial /fungal)	9 (7.82%)	11 (9.56%)
Ulcer & gangrene of foot	3 (2.60%)	4 (3.47%)
Pruritus	7(6.08%)	8(6.95%)
Diabetic dermopathy	5(4.34%)	7(6.08%)
Foot swelling	4 (3.47%)	5(4.34%)
Thick and scaly skin	5(4.34%)	5 (4.34%)
Pigmentation, including shin spots	4(3.47%)	5(4.34%)
Cellulitis	5(4.34%)	2(1.73%)
Acanthosis nigricans	3(2.60%)	3(2.60%)
Yellow nails	3(2.60%)	3(2.60%)
Skin tags	1 (0.86%)	3(2.60%)
Psoriasis	1(0.86%)	3(2.60%)

The relationship between cutaneous manifestations and glycemic control was investigated in 200 patients. Among these, 125 patients exhibited skin manifestations, while 75 did not. The HbA1c levels of the patients were used to divide them into two groups. In the HbA1c range of 5 to 8%, a majority of 83% of patients fell into this category. Within this group, 91.2% of those with skin manifestations had HbA1c levels in this range, while 69.3% of those without skin manifestations fell into the same category. Moving into the HbA1c range of 8.1 to 14%, 17% of patients were in this category. Among them, 8.8% with skin manifestations had HbA1c levels in this range, whereas a higher proportion of 30.6% without skin manifestations fell into this category. These findings underscore a noteworthy association between higher HbA1c levels and the presence of cutaneous manifestations, particularly within the higher range of 8.1 to 14% **(Table III).**

Table III: Relationship of Cutaneous Manifestations with Glycemic Control

HbA1c Range	Total Patients (n=200)	with skin manifestations (n=125)	without skin manifestations (n=75)
5 to 8 (%)	166(83.0%)	114(91.2%)	52(69.3%)
8.1 to 14 (%)	34(17.0%)	11(8.8%)	23(30.6%)

One hundred twenty-five patients displayed skin manifestations, while 75 did not. The patients were categorized into three groups according to how long they had had diabetes. In the group with Diabetes duration of less than five years, comprising 56% of the patients, 50.4% exhibited skin manifestations, whereas 65.3% were without. The 5-9 years category constituted 27% of the patients; 25.6% with skin manifestations fell into this range, while 29.3% without skin manifestations were in the same category. Lastly, in the group with diabetes duration exceeding ten years, constituting 17% of the patients, a significant 24% exhibited skin manifestations, while only 5.3% were without. These results highlight a notable correlation between the duration of diabetes and the presence of cutaneous manifestations, with a higher prevalence observed in patients with diabetes for longer durations **(Table IV)**.

Table IV: Relationship of Cutaneous Manifestations with Duration of Diabetes

Duration of Diabetes	Total Patients (n=200)	Patients withskin manifestations (n=125)	Patients without skin manifestations (n=75)
< 5 years	112(56%)	63(50.4%)	49(65.3%)
5-9 years	54(27%)	32(25.6%)	22(29.3%)
>10 years	34(17%)	30(24%)	04(5.3%)

DISCUSSION

Over the years, diabetes has been linked to multiple degenerative changes that impact the eyes, skin, peripheral & central nervous systems and the cardiovascular system. Because of their many and intricate consequences, doctors should investigate the cutaneous complications linked to this disease[4].

The observed higher prevalence of skin manifestations among females in our study is consistent with findings reported by Bhat YJ 2006[13], Ahmed K 2009[14] and Chakrabarty A 2008[15]. This gender difference may be attributed to hormonal influences on skin health, as suggested by Bhat YJ 2006[13].

The high prevalence of bacterial and fungal infections in diabetics, as observed in our study, is consistent with extensive research highlighting the heightened susceptibility of individuals with diabetes to such skin issues. Many Studies[16-18] has consistently reported elevated rates of bacterial and fungal infections in diabetic populations, underscoring the well-established association between diabetes and increased vulnerability to skin infections in people with diabetes. The incidence of ulcers and gangrene in males in the current study resonates with the work of Lin C 2020[19] and Stancu B et al.[20], who emphasized the influence of anatomical factors and potential variations in vascularity between genders in the development of diabetic foot complications.

13.33% of the participants were found to have Pruritus, with relatively balanced rates observed in both genders, which contradicts two past studies done by Boss R 2020[21] and Henry D 2020[6], which showed that the most prevalent skin symptom among type 2 diabetic patients was Pruritus.

Similarly, the prevalence of diabetic dermopathy, thick

and scaly skin, pigmentation issues, and shin spots in the current study aligns with the findings of three studies that show various metabolic and microvascular factors are responsible for these changes in diabetics[23-25].

The higher incidence of Cellulitis in males in our study may be attributed to potential differences in immune response and skin structure, as suggested by research conducted by Vâță D et al[24] in 2023.

Our study showed almost similar prevalence of Acanthosis nigricans, Yellow nails, skin tags and psoriasis exhibiting that resonate with the work of Garg P 2021[25] and Verma A 2019[26] underscoring the complex interplay of genetic, hormonal, and immunological factors.

The findings of this study elucidate a significant relationship between glycemic control, as indicated by HbA1c levels, and the presence of cutaneous manifestations in individuals with diabetes. The division of patients into two groups based on HbA1c levels provided valuable insights into this association. This high percentage suggests a strong correlation between elevated HbA1c levels and cutaneous manifestations, as previous studies by Chate A 2021[27], Poorana B 2019[28] and Umičević-Šipka S 2021[18] suggested.

To sum up, the results of this investigation offer strong proof that people with diabetes have cutaneous manifestations associated with glycemic controls, reflected by HbA1c levels. Maintaining optimal glycemic levels is critical in reducing the risk of dermatological complications.

CONCLUSION

In conclusion, our study provides valuable insights into the prevalence and types of skin manifestations associated with diabetes mellitus. These findings have important clinical implications for the early detection and management of these complications, as highlighted by several studies in the field.

LIMITATIONS

The small sample size, participants from particular clinical settings, and demographics are the study's constraints that may limit the applicability of the findings to a larger population. Dermatological manifestations may be underestimated due to underreporting by patients and neglect on the part of healthcare professionals, particularly in asymptomatic and mild cases. The brief follow-up periods may not have captured the emergence and evolution of persistent dermatological symptoms over time.

FUTURE RECOMMENDATIONS

Long-term follow-up is advised to gain insights into the gradual development of these manifestations. Diverse populations should be involved in this follow-up to obtain more reliable prevalence estimates and to identify possible risk elements that could influence prevention, detection, and treatment approaches. Frequent evaluations allow medical professionals to pinpoint patients at high risk and put preventative measures in place to lessen the chance of consequences like diabetic neuropathy, peripheral vascular disease, and amputation of the lower limb. Mechanistic investigations and Biomarkers of endothelial dysfunction, oxidative stress, or inflammation can be used to determine the underlying molecular and pathophysiological mechanisms of diabetic dermatological problems and uncover potential treatment targets. Future Longitudinal studies can improve clinical care, patient outcomes, and the quality of life for diabetics by following these recommendations and deepening our understanding of the intricate interactions between diabetes and dermatological health.

Ethical permission: Liaquat College of Medicine & Dentistry, Karachi, IRB letter No. IRB/M-000065/23.

Conflict of Interest: No conflicts of interest

Financial Disclosure / Grant Approval: No funding agency was involved in this research.

Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Fahad R: Conceive research idea, designing the study, and overseeing the project and data collection.
Soban M: Data collection, conducting the experiments and gathering information for the study.
Qasim SF: Data collection, data analysis, statistical analysis
Aziz Z: corresponding author, writing and drafting the manuscript, including preparing figures and tables.
Mughal F: Data analysis, statistical analysis, provide oversight, supervision and guided the overall direction of the research.
Azim F: Literature review, background research, conducting a critical review of existing work in the field.

REFERENCES

1. Tomic D, Shaw JE, Magliano DJ. The burden and risks of emerging complications of diabetes mellitus. Nat Rev Endocrinol. 2022; 18(9): 525-39. doi: 10.1038/s41574-022-00690-7. Epub 2022 Jun 6.
2. Suryasa IW, Rodríguez-Gámez M, Koldoris T. Health and treatment of Diabetes mellitus. Int J Health Sci. 2021; 5(1): 1-5. doi: 10.53730/ijhs.v5n1.2864.
3. Oguntibeju OO. Type 2 diabetes mellitus, oxidative stress and inflammation: examining the links. Int J Physiol Pathophysiol Pharmacol. 2019; 11(3): 45-63.
4. Hines A, Alavi A, Davis MD. Cutaneous manifestations of diabetes. Med Clin North AM. 2021; 105(4): 681-97. doi: 10.1016/j.mcna.2021.

04.008.
5. Sanches MM, Roda Â, Pimenta R, Filipe PL, Freitas JP. Cutaneous manifestations of diabetes mellitus and pre-diabetes. Acta Med Port. 2019; 32(6): 459-65. doi: 10.20344/amp.10738.
6. 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.
7. Reschke F, Biester T, Von dem Berge T, Jamiolkowski D, Hasse L, Dassie F et al. Skin manifestations in rare types of diabetes and other endocrine conditions. Endocr Connect. 2023; 12 (7): e220410. doi: 10.1530/EC-22-0410.
8. Chen VY, Siegfried LG, Tomic□Canic M, Stone RC, Pastar I. Cutaneous changes in diabetic patients: primed for aberrant healing? Wound Rep Regener. 2023; 31(5): 700-712. doi: 10.1111/wrr. 13108. Epub 2023 Jul 19.
9. Rodríguez-Rodríguez N, Martínez-Jiménez I, García-Ojalvo A, Mendoza-Mari Y, Guillén-Nieto G, Armstrong DG et al. Wound chronicity, impaired immunity and infection in diabetic patients. MEDICC Rev. 2022; 24(1): 44-58. doi: 10.37757/MR2021.V23.N3.8.
10. Svoboda SA, Shields BE. Cutaneous manifestations of nutritional excess: Pathophysiologic effects of hyperglycemia and hyperinsulinemia on the skin. Cutis. 2021; 107(2): 74-8. doi: 10.12788/cutis.0173.
11. Awuchi CG, Echeta CK, Igwe VS. Diabetes and the nutrition and diets for its prevention and treatment: A systematic review and dietetic perspective. Health Sci Res. 2020; 6(1): 5-19.
12. Gkogkolou P, Böhm M. Skin disorders in diabetes mellitus. JDDG. 2014; 12(10): 847-64. doi: 10.1111/ddg.12424.
13. Bhat YJ, Gupta V, Kudyar RP. Cutaneous manifestations of Diabetes mellitus. Int J Diab Dev Ctries. 2006; 26: 152-5.
14. Ahmed K, Muhammad Z, Qayum I. Prevalence of cutaneous manifestations of Diabetes mellitus. J Ayub Med Coll Abbottabad. 2009; 21(2): 76-9.
15. Chakrabarty A, Norman RA, Phillips TJ. Cutaneous manifestations of diabetes. In: Diagn Aging Skin Dis. 2008; pp. 253-263. London: Springer London.
16. Saxena M, Ajula SS. Observational study of cutaneous manifestations among patients of diabetes mellitus. Int J Med Sci Educ. 2021; 8(1): 46-49.
17. Kumar D, Mehta RD, Ghiya BC, Soni P, Agrawal AM. An epidemiological study of cutaneous manifestations of diabetes mellitus at Tertiary Care Centre of North West Rajasthan (India). Our Dermatol Online. 2022; 13(e): e51. doi: 10.7241/ ourd.2022e.51.
18. Umičević-Šipka S, Balaban J, Bijelić R. Association between skin manifestations and glycemic control in patients with type 2 diabetes mellitus. Vojnosanitetski pregled. 2021; 78(3): 323 -330. doi: 10.2298/VSP190226073U.
19. Lin C, Liu J, Sun H. Risk factors for lower extremity amputation in patients with diabetic foot ulcers: A meta-analysis. PloS One. 2020; 15(9): e0239236. doi: 10.1371/journal.pone.0239236.
20. Stancu B, Ilyés T, Farcas M, Coman HF, Chiș BA, Andercou OA. Diabetic foot complications: a retrospective cohort study. Int J Environ Res Public Health. 2022; 20(1): 187. doi: 10.3390/ ijerph20010187.
21. Bose R, Kumar S. Dermatological manifestations in diabetes mellitus. IP Indian J Clin Exper Dermatol. 2020; 6(2): 136-144.
22. Buckley D. Skin Problems Associated with Diabetes. Textbook of Primary Care Dermatology. 2021: 489-93.
23. Andamari I, Thio HB, Soebono H. Potential skin problems of diabetes mellitus patients: a review. J Med Sci. 2022; 54(3): 295-307. doi: 10.19106/ MedSci005403202211.
24. 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. doi: 10.3390/diseases 11030106.
25. Garg P, Chandra M. Cutaneous Manifestation of Diabetes mellitus. J Adv Med Dent Sci Res. 2021; 9(5): 100-5.
26. Verma A, Pandya P, Sharma D. Skin manifestations in patients with type-II diabetes mellitus. Int J Res Rev. 2019; 6(9): 59-65.
27. Chate A, Swami A, Rane S, Gosavi R. A Cross-Sectional Study to Evaluate Cutaneous Manifestations in Diabetic Patients and their Correlation with Sugar Control at Tertiary Care Center in Western Maharashtra. VIMS Health Sci J. 2021; 8(3): 104-8.
28. Poorana B, Prasad PV, Kaviarasan PK, Selvamuthukumaran S, Kannambal K. Impact of Glycaemic Control on the Pattern of Cutaneous Disorders in Diabetes Mellitus-A Hospital-Based Case-Control Study. J Clin Diagn Res. 2019; 13 (2): WC01-WC05. doi: 10.7860/JCDR/2019/ 36742.12604.