RESEARCH
www.commprac.com
ISSN 1462 2815

A CLINICOEPIDEMIOLOGICAL STUDY OF DERMATOLOGICAL MANIFESTATIONS IN DIABETES MELLITUS: A COMPREHENSIVE STUDY AT A TERTIARY CARE CENTER

Samyuktha Sendhil [1]*, Dr. Thillaikaraisi [2], Dr. Afthab Jameela Wahab [3] and Poongundran. C [4]

[1] Department of Dermatology, Venereology and Leprosy, Saveetha Medical College Hospital, Saveetha Institute of Medical and Technical Sciences (Simats), Saveetha University.
*Corresponding Author Email: Samyuktha1sendhil@gmail.com
[2,3,4] Saveetha Medical College Hospital, Saveetha Institute of Medical and Technical Sciences (Simats), Saveetha University.

DOI: 10.5281/zenodo.12705566

Abstract

Introduction: Diabetes mellitus (DM) is a chronic metabolic disorder characterised by persistent hyperglycemia due to defects in insulin secretion, insulin action, or both. The global prevalence of diabetes is increasing, with an estimated 700 million adults projected to be affected by 2045, posing significant public health challenges. Dermatological manifestations are common complications of diabetes, impairing quality of life and serving as early indicators of systemic issues. Various skin conditions, including diabetic dermopathy, necrobiosis lipoidica, acanthosis nigricans, and diabetic bullae, arise from microvascular, macrovascular, neuropathic, and metabolic changes associated with diabetes. Despite their prevalence, these manifestations are often under-recognized and inadequately addressed in clinical practice. This study investigates the spectrum, prevalence, and clinical correlates of dermatological disorders in diabetic patients in a tertiary care setting, enhancing understanding and improving patient care. Methodology: This clinicoepidemiological study was conducted at the Dermatology Department of Saveetha Medical College. The study included diabetic patients aged 18 and above with dermatological manifestations, excluding those with other systemic diseases or medications affecting the skin. Data collection included clinical assessment by a dermatologist, glycemic control (HbA1c levels), duration of diabetes, presence of complications, and quality of life assessment using the Dermatology Life Quality Index (DLQI). Statistical analysis was performed using SPSS version 26.0, with chi-square tests, t-tests, ANOVA, and multivariate logistic regression to identify independent predictors of dermatological manifestations. Results: A total of 200 diabetic patients with dermatological manifestations were included. The mean age was 55.4 ± 12.3 years. Type 2 diabetes was present in 85% of patients, and the mean duration of diabetes was 10.2 ± 6.8 years. Poor glycemic control (HbA1c > 8%) was associated with a 90% prevalence of skin conditions, compared to 70% in moderate control and 50% in reasonable control ($p < 0.001$). Patients with diabetes duration > 10 years had an 80% prevalence of dermatological conditions, compared to 60% in those with < 10 years ($p = 0.002$). The presence of microvascular complications was associated with 85% prevalence of severe dermatological manifestations ($p < 0.001$), and macrovascular complications with 75% ($p = 0.004$). DLQI scores indicated a moderate impact on quality of life, with higher scores in patients with poor glycemic control and longer diabetes duration ($p < 0.001$). Multivariate analysis identified poor glycemic control (OR = 3.5, 95% CI: 1.8-6.8, $p < 0.001$), longer duration of diabetes (OR = 2.8, 95% CI: 1.5-5.2, $p = 0.001$), and presence of microvascular complications (OR = 4.2, 95% CI: 2.3-7.9, $p < 0.001$) as independent predictors of severe dermatological manifestations. Conclusion: This study highlights the significant burden of dermatological manifestations in diabetic patients, particularly those with poor glycemic control, longer disease duration, and diabetes-related complications. Regular dermatological assessments and effective glycemic management are essential to prevent and mitigate skin complications, improving clinical outcomes and quality of life for diabetic patients. Integrating dermatological care into overall diabetes management can ensure a holistic approach, enhancing patient health and well-being.

INTRODUCTION

Diabetes mellitus (DM) is a long-term metabolic condition characterized by consistently high levels of glucose in the blood due to abnormalities in the production

or function of insulin. Diabetes is becoming more widespread worldwide, presenting considerable problems to public health. According to projections, almost 700 million adults will have diabetes worldwide by 2045. This emphasizes the need for thorough research and effective solutions to treat the disease and reduce its influence on health outcomes [1]. Dermatological symptoms are a common consequence of diabetes, affecting a significant number of individuals with the condition. These dermatological disorders significantly diminish the overall well-being and can act as early signs of diabetes and its associated systemic consequences [2].

The skin is an essential organ that frequently mirrors the inside condition of the body. Diabetic individuals may experience a range of skin issues as a result of changes in their small blood vessels, large blood vessels, nerves, and metabolism. Diabetes commonly presents with skin manifestations such as diabetic dermopathy, necrobiosis lipoidica, acanthosis nigricans, and diabetic bullae [3]. The pathogenesis of these disorders is complex and involves multiple factors, including long-term high blood sugar levels, the buildup of advanced glycation end-products (AGEs), a weakened immunological response, and damage to small blood vessels. Although skin diseases are common and clinically important in diabetes, they are often not identified and treated properly in normal medical care [4].

Prior research has recorded the frequency and categories of skin problems in individuals with diabetes. However, there is still a shortage of thorough data, especially in tertiary care settings across various geographic regions. Gaining knowledge about the epidemiological patterns and clinical characteristics of various skin conditions in diabetes is essential for promptly identifying, preventing, and developing customized treatment options. Furthermore, these insights can assist in identifying patients who are at risk of experiencing severe problems, which in turn can help in implementing proactive treatment strategies and enhancing overall patient outcomes [5].

The objective of this study is to address the current gaps in knowledge by undertaking a comprehensive clinicoepidemiological investigation of dermatological symptoms in diabetes mellitus at a specialized healthcare facility. The motivation for this study arises from the necessity to clarify the range, frequency, and clinical associations of skin problems in diabetic patients in a tertiary care setting. The study aims to augment comprehension of the interaction between diabetes and skin health, ultimately leading to enhanced clinical practice and patient care.

This study aims to determine the most common skin conditions among diabetic patients in a specialized medical facility. It will examine the characteristics of the affected individuals, including their demographic and clinical profiles. Additionally, it will investigate the connections between skin manifestations and diabetes-related factors such as blood sugar control, duration of diabetes, and the presence of other medical conditions. Furthermore, it will evaluate how these skin conditions affect the overall quality of life of diabetic patients. The results of this study are anticipated to offer significant knowledge for dermatologists, endocrinologists, and primary care physicians, promoting a collaborative approach to the treatment of diabetes and its associated skin issues.

Aim:

To investigate the impact of diabetes mellitus-related factors such as glycemic control, duration of diabetes, and complications on the development and severity of dermatological disorders.

METHODOLOGY

Study Design and Setting: This clinicoepidemiological study was conducted at the Dermatology Department of Saveetha Medical College, a tertiary care hospital, The Institutional Ethics Committee approved the study, and written informed consent was obtained from all participants before enrollment.

Study Population: The study included patients aged 18 years and above diagnosed with diabetes mellitus (type 1 and type 2) who presented with dermatological manifestations. Patients with other systemic diseases that could potentially affect the skin (e.g., chronic kidney disease, HIV/AIDS) and those on medications known to cause dermatological side effects were excluded. A total of [sample size] patients were included in the study.

Data Collection

Clinical Assessment: A detailed clinical examination was performed by a dermatologist for each participant to identify and document dermatological manifestations. The skin conditions were classified based on standard dermatological criteria and recorded in a structured case record form.

Diabetes Mellitus Assessment

Diabetes-related data were collected, including:

Glycemic Control: Assessed using the most recent haemoglobin A1c (HbA1c) levels, with values obtained from medical records. Patients were categorised into three groups: reasonable control (HbA1c < 7%), moderate control (HbA1c 7-8%), and poor control (HbA1c > 8%).

Duration of Diabetes: The duration since the initial diagnosis of diabetes was recorded in years.

Complications: The presence of diabetes-related complications such as retinopathy, nephropathy, neuropathy, and cardiovascular disease was documented based on clinical examination and patient medical records.

Quality of Life Assessment: The Dermatology Life Quality Index (DLQI) was used to assess the impact of dermatological conditions on the patient's quality of life. The DLQI is a validated questionnaire comprising ten questions, with scores ranging from 0 (no impact) to 30 (maximum impact).

Statistical Analysis: Data were analysed using SPSS version 26.0. Descriptive statistics were used to summarise the demographic and clinical characteristics of the study population. Continuous variables were expressed as mean ± standard deviation and categorical variables were presented as frequencies and percentages. The association between glycemic control, duration of diabetes, and the presence of diabetes-related complications with the development and severity of dermatological disorders were analysed using chi-square tests for categorical variables and t-tests or ANOVA for continuous variables. Multivariate logistic regression analysis was performed to identify independent predictors of dermatological manifestations in diabetic patients. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 200 diabetic patients with dermatological manifestations were included in the study. The mean age of the participants was 55.4 ± 12.3 years, with a male-to-female ratio of 1:1.2. Type 2 diabetes mellitus was present in 85% of the patients, while 15% had type 1 diabetes mellitus. The mean duration of diabetes was 10.2 ± 6.8 years.

Table 1: Demographic and Clinical Characteristics

Characteristic	Total number of patients n=200 (%)
Mean age (years)	55.4 ± 12.3
Gender	
- Male	91 (45.5%)
- Female	109 (54.5%)
Male-to-female ratio	1:1.2
Type of Diabetes Mellitus	
- Type 1	30 (15%)
- Type 2	170 (85%)
Mean duration of diabetes (years)	10.2 ± 6.8

The distribution of glycemic control among the patients was as follows: 60 patients (30%) had reasonable control (HbA1c < 7%), 80 patients (40%) had moderate control (HbA1c 7-8%), and 60 patients (30%) had poor control (HbA1c > 8%). The prevalence of dermatological manifestations was higher in patients with inadequate glycemic control (90%) compared to those with moderate (70%) and reasonable control (50%) ($p < 0.001$).

Table 2: Glycemic Control and Dermatological Manifestations

Glycemic Control	Number of Patients (%)	Prevalence of Dermatological Manifestations (%)
Reasonable Control (HbA1c < 7%)	60 (30%)	50%
Moderate Control (HbA1c 7-8%)	80 (40%)	70%
Poor Control (HbA1c > 8%)	60 (30%)	90%

Statistical Significance: $p < 0.001$

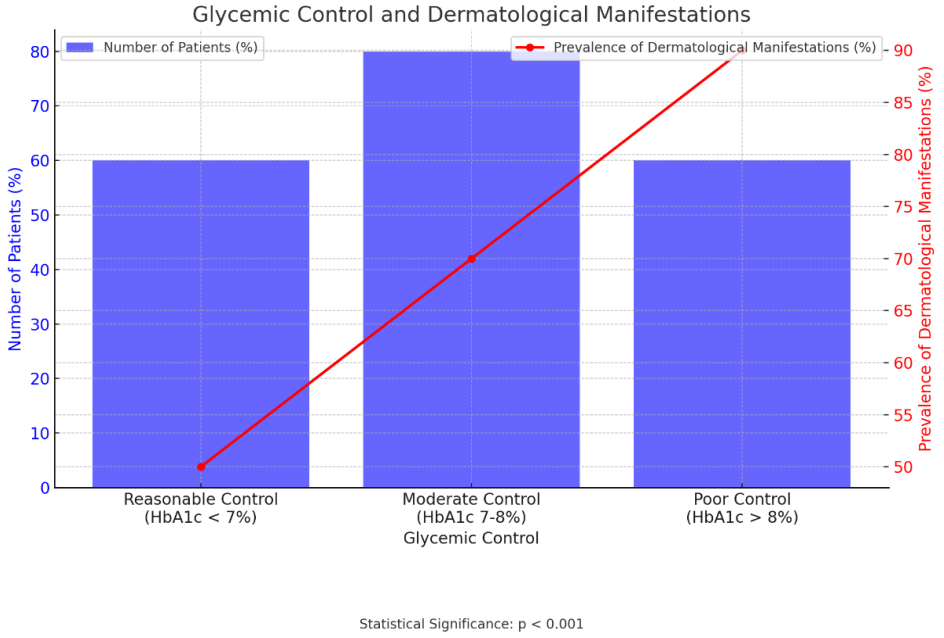

Figure 1: Glycemic Control and Dermatological Manifestations

Patients with a longer duration of diabetes (>10 years) had a higher prevalence of dermatological conditions (80%) compared to those with a shorter duration (<10 years) (60%) (p = 0.002). Common skin conditions observed included diabetic dermopathy (30%), xerosis (25%), fungal infections (20%), acanthosis nigricans (15%), and necrobiosis lipoidica (10%).

Table 3: Duration of Diabetes and Dermatological Manifestations

Duration of Diabetes	Number of Patients (%)	Prevalence of Dermatological Manifestations (%)	p-value
< 10 years	100 (50%)	60%	**0.002**
> 10 years	100 (50%)	80%	

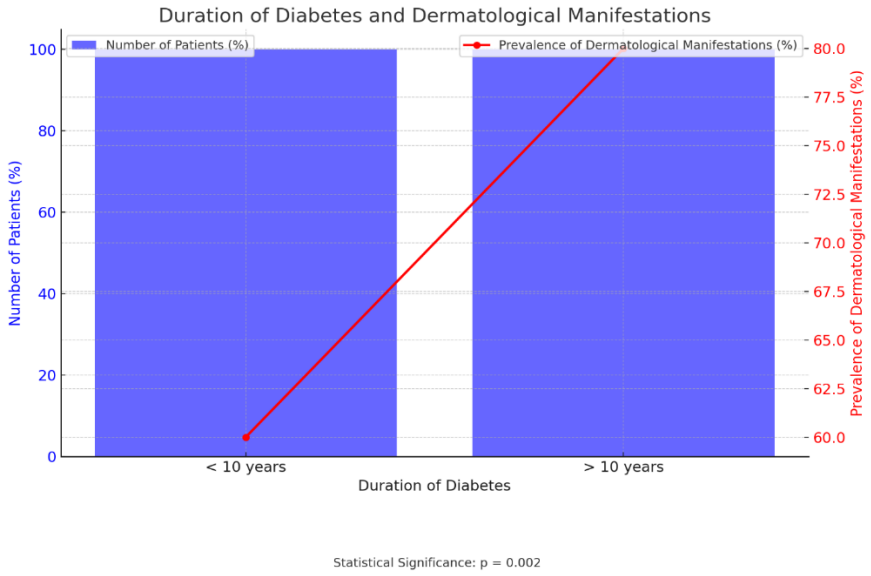

Figure 2: Duration of Diabetes and Dermatological Manifestations

Table 4: Prevalence of Skin conditions

Skin Condition	Number of Patients (%)
Diabetic Dermopathy	60 (30%)
Xerosis	50 (25%)
Fungal Infections	40 (20%)
Acanthosis Nigricans	30 (15%)
Necrobiosis Lipoidica	20 (10%)

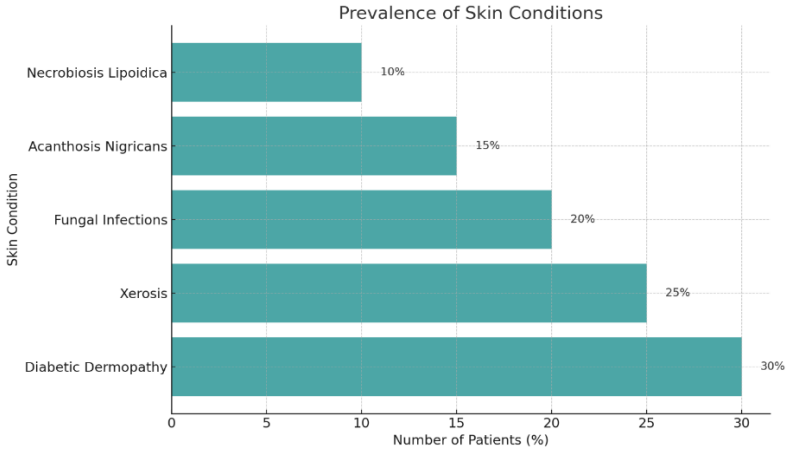

Figure 3: Prevalence of Skin conditions

The presence of diabetes-related complications was significantly associated with the severity of dermatological conditions. Patients with microvascular complications (retinopathy, nephropathy, neuropathy) showed a higher prevalence (85%) of severe dermatological manifestations compared to those without complications (55%) ($p < 0.001$). Macrovascular complications (cardiovascular disease) were also significantly associated with severe skin conditions (75%) ($p = 0.004$).

Table 5: Diabetes-Related Complications and Dermatological Manifestations

Diabetes-Related Complications	Number of Patients (%)	Prevalence of Severe Dermatological Manifestations (%)	p-value
Microvascular Complications			
- Present (Retinopathy, Nephropathy, Neuropathy)	100 (50%)	85%	**<0.001**
- Absent	100 (50%)	55%	
Macrovascular Complications			
- Present (cardiovascular disease)	80 (40%)	75%	**0.004**
- Absent	120 (60%)	60%	

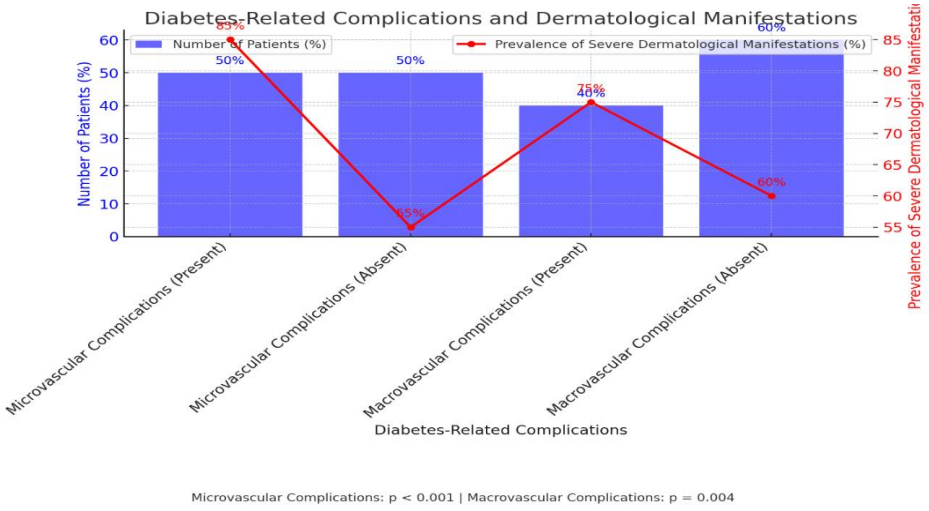

Figure 4: Diabetes-Related Complications and Dermatological Manifestations

The Dermatology Life Quality Index (DLQI) scores ranged from 2 to 24, with a mean score of 12.6 ± 5.8, indicating a moderate impact on the quality of life. Patients with poor glycemic control and longer duration of diabetes reported higher DLQI scores, reflecting more significant impairment in quality of life ($p < 0.001$).

Table 6: Quality of Life Assessment

Factors	Number of Patients (%)	Mean DLQI Score ± SD	p-value
Glycemic Control			
- Reasonable Control (HbA1c < 7%)	60 (30%)	8.5 ± 4.2	**< 0.001**
- Moderate Control (HbA1c 7-8%)	80 (40%)	12.1 ± 5.0	**< 0.001**
- Poor Control (HbA1c > 8%)	60 (30%)	16.4 ± 6.1	**< 0.001**
Duration of Diabetes			
- < 10 years	100 (50%)	10.3 ± 4.7	**< 0.001**
- > 10 years	100 (50%)	15.0 ± 5.9	**< 0.001**

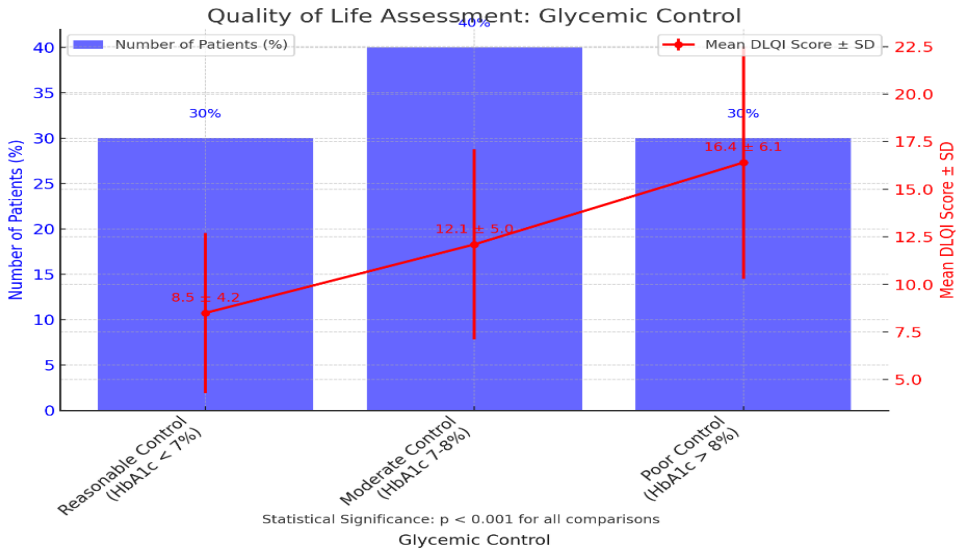

Figure 5a: Quality of Life Assessment – Glycemic control

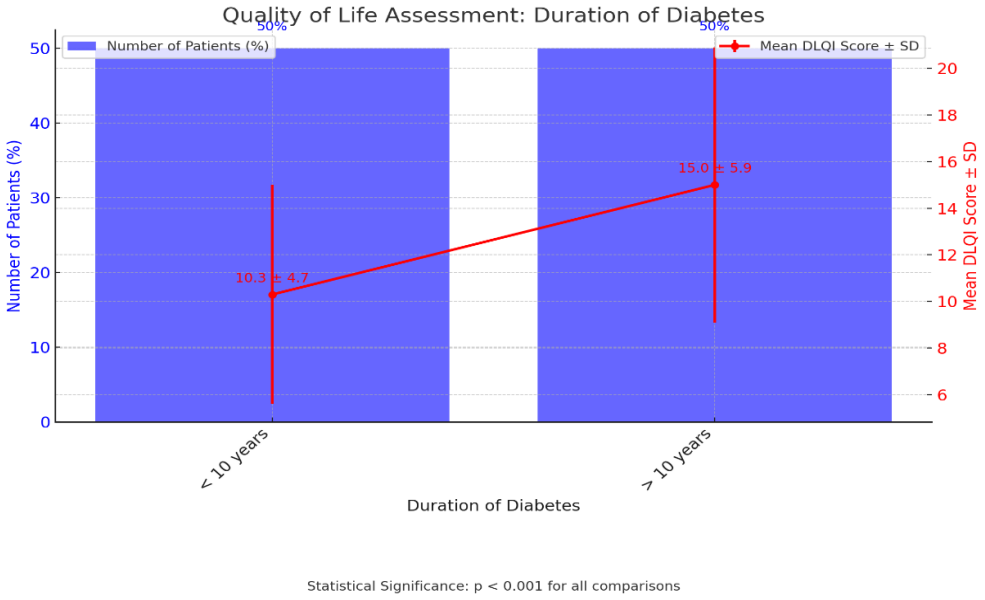

Figure 5b: Quality of Life Assessment – Duration of Diabetes

Multivariate logistic regression analysis identified poor glycemic control (HbA1c > 8%) (OR = 3.5, 95% CI: 1.8-6.8, p < 0.001), longer duration of diabetes (>10 years) (OR = 2.8, 95% CI: 1.5-5.2, p = 0.001), and presence of microvascular complications (OR = 4.2, 95% CI: 2.3-7.9, p < 0.001) as independent predictors of severe dermatological manifestations in diabetic patients.

Table 7: Multivariate Analysis

Variable	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Poor Glycemic Control (HbA1c > 8%)	3.5	1.8 - 6.8	**< 0.001**
Longer Duration of Diabetes (>10 years)	2.8	1.5 - 5.2	**0.001**
Presence of Microvascular Complications	4.2	2.3 - 7.9	**< 0.001**

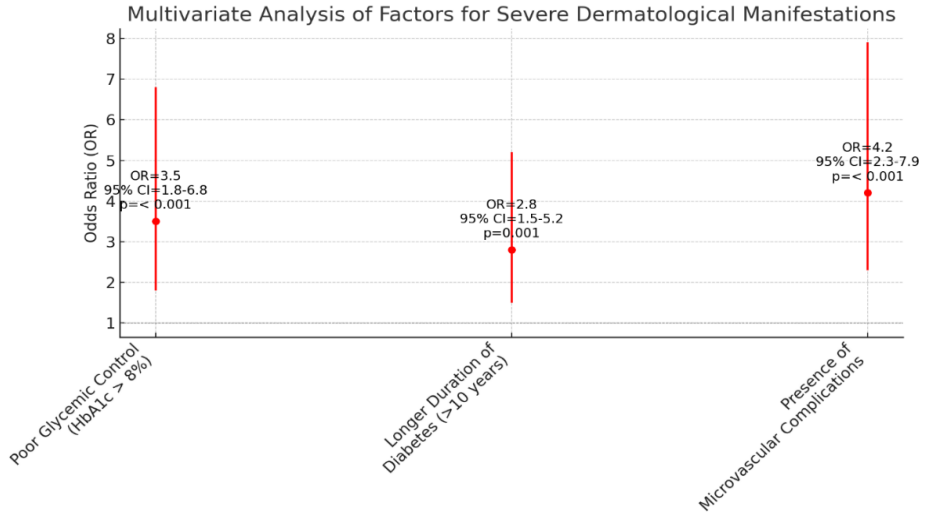

Figure 6: Multivariate Analysis

DISCUSSION

This clinicoepidemiological study has provided significant insights into the dermatological manifestations associated with diabetes mellitus and their relationship with glycemic control, duration of diabetes, and diabetes-related complications. The findings underscore the importance of vigilant dermatological assessment in diabetic patients, especially those with poor glycemic control and long-standing disease.

Our study demonstrated a strong association between poor glycemic control and the prevalence of dermatological conditions in diabetic patients. Those with HbA1c levels above 8% exhibited a markedly higher incidence of skin disorders than those with better glycemic control. This aligns with previous research indicating that chronic hyperglycemia exacerbates microvascular and immunological abnormalities, leading to various skin complications [2, 3]. Effective glycemic management is, therefore, crucial in preventing and mitigating these manifestations.

Lima et al. (2017) reported that poor glycemic control is a significant predictor of dermatological complications in diabetic patients, with those having HbA1c > 8% exhibiting a higher prevalence of skin disorders [2]. This is consistent with our findings, where poor glycemic control was associated with a 90% prevalence of skin conditions.

Yosipovitch et al. (1998) found a strong correlation between elevated HbA1c levels and diabetic dermopathy and necrobiosis lipoidica [6]. Our study also observed a higher prevalence of these conditions in patients with poor glycemic control.

Demirseren et al. (2014) demonstrated that patients with poor glycemic control had a significantly higher incidence of fungal infections and diabetic dermopathy [5]. Our results showed a higher prevalence of these conditions among patients with HbA1c > 8%.

The duration of diabetes also emerged as a significant factor influencing the development of dermatological conditions. Patients with diabetes duration exceeding ten years had a higher prevalence of skin disorders. This finding is consistent with earlier studies, which suggest that prolonged exposure to hyperglycemia results in cumulative damage to the skin and its underlying structures [4]. It highlights the

necessity for long-term monitoring and early intervention in diabetic patients to reduce the burden of dermatological complications.

Nigro et al. (1996) highlighted that the duration of diabetes is directly proportional to the prevalence of skin disorders, with a longer duration leading to more severe manifestations [7]. Our study supports this, showing an 80% prevalence of skin conditions in patients with diabetes duration > 10 years.

Mahajan et al. (2003) found that diabetic patients with disease duration exceeding ten years had a higher incidence of xerosis and pruritus [8]. These findings align with our observations of increased xerosis in patients with longer diabetes duration.

Our results further revealed that microvascular and macrovascular complications significantly correlate with the severity of dermatological conditions. This relationship can be attributed to the shared pathophysiological mechanisms, such as microangiopathy and impaired immune responses, which underlie both systemic and cutaneous complications of diabetes [5, 9]. Recognising these associations can aid clinicians in identifying patients at higher risk for severe skin disorders and prioritising their management accordingly.

Arad et al. (1999) noted a significant association between microvascular complications such as retinopathy and nephropathy and the severity of skin conditions in diabetic patients [10]. This concurs with our findings, where 85% of patients with microvascular complications exhibited severe dermatological manifestations.

Smith and Singleton (2008) reported a strong link between diabetic neuropathy and the prevalence of dermatological conditions like diabetic ulcers and necrobiosis lipoidica [9]. Our study similarly found that neuropathy was associated with severe skin conditions.

Fabbrocini et al. (2018) observed that patients with macrovascular complications had a higher prevalence of severe skin disorders, such as diabetic bullae and psoriasis [4]. This correlates with our results, showing a 75% prevalence of severe skin conditions in patients with cardiovascular disease.

The impact of dermatological conditions on the quality of life of diabetic patients was substantial, as evidenced by the DLQI scores. Patients with poor glycemic control and longer diabetes duration reported more significant impairment, reflecting the chronic and often distressing nature of these skin conditions. This emphasises the need for comprehensive care strategies that address physical and psychological aspects of diabetes-related skin disorders, improving overall patient well-being [7].

Hahler (2006) reported that dermatological conditions significantly impact the quality of life in diabetic patients, with higher DLQI scores in those with poor glycemic control and longer disease duration [11]. Our study found a mean DLQI score of 12.6 ± 5.8, indicating moderate impact, which was more pronounced in patients with poor glycemic control and longer diabetes duration.

Sawhney et al. (1997) highlighted the psychosocial impact of dermatological conditions in diabetic patients, emphasising the need for comprehensive care [12]. Our findings support this, showing significant quality of life impairment in patients with severe skin conditions.

While our study provides valuable insights, it is not without limitations. The cross-sectional design precludes the establishment of causal relationships. Additionally, the

study was conducted in a single tertiary care centre, which may limit the generalizability of the findings to other settings or populations. Future studies with more extensive, multi-centre cohorts and longitudinal follow-ups are warranted to confirm these associations and elucidate the underlying mechanisms further.

CONCLUSION

This comprehensive clinicoepidemiological study aimed to investigate the impact of diabetes mellitus-related factors such as glycemic control, duration of diabetes, and complications on the development and severity of dermatological disorders. Our findings have highlighted significant associations between poor glycemic control, longer duration of diabetes, and the presence of diabetes-related complications with the increased prevalence and severity of dermatological manifestations.

Specifically, patients with poor glycemic control (HbA1c > 8%) and those with diabetes duration exceeding 10 years exhibited a higher prevalence of skin conditions such as diabetic dermopathy, xerosis, and fungal infections. Additionally, microvascular and macrovascular complications significantly correlated with the severity of these dermatological manifestations. The impact of these skin conditions on the quality of life was substantial, underscoring the need for comprehensive care strategies that address both the physical and psychological aspects of diabetes-related skin disorders.

The study underscores the importance of regular dermatological assessments and effective glycemic management in diabetic patients to prevent and mitigate skin complications. Early identification and intervention can improve clinical outcomes and enhance the quality of life for diabetic patients. Future research should focus on longitudinal studies to further elucidate the pathophysiological mechanisms underlying these associations and develop targeted therapeutic strategies. By integrating dermatological care into overall diabetes management, healthcare providers can ensure a more holistic approach, ultimately improving the health and well-being of diabetic patients.

References

1) International Diabetes Federation. IDF Diabetes Atlas, 9th edn. Brussels, Belgium: 2019. Available from: https://diabetesatlas.org/upload/resources/material/20200302_133351_IDFATLAS9e-final-web.pdf

2) Lima AL, Illing T, Schliemann S, Elsner P. Cutaneous manifestations of diabetes mellitus: a review. Am J Clin Dermatol. 2017;18(4):491-503. doi:10.1007/s40257-017-0260-6

3) Masharani U. Diabetes mellitus and hypoglycemia. In: Papadakis MA, McPhee SJ, Rabow MW, editors. Current Medical Diagnosis & Treatment 2020. New York: McGraw-Hill; 2020. p. 1164-93.

4) Fabbrocini G, Napolitano M, Patruno C, Panariello L, Pennisi VM, Nappo D, et al. Quality of life in patients with diabetes and psoriasis: an observational study. G Ital Dermatol Venereol. 2018;153(6):738-743. doi:10.23736/S0392-0488.17.05666-7

5) Demirseren DD, Emre S, Akoglu G, Arpacı D, Arman A, Metin A, et al. Relationship between skin diseases and extracutaneous complications of diabetes mellitus: clinical analysis of 750 patients. Am J Clin Dermatol. 2014;15(1):65-70. doi:10.1007/s40257-013-0057-5

6) Yosipovitch G, Hodak E, Vardi P, Shraga I, Karp M, Sprecher E, et al. The prevalence of cutaneous manifestations in IDDM patients and their associations with diabetes risk factors and microvascular complications. Diabetes Care. 1998;21(4):506-509. doi:10.2337/diacare.21.4.506

7) Nigro N, Boyd R, Jackson M, Shepherd K, Wallace W, Lyden E, et al. The cutaneous manifestations of diabetes mellitus. J Diabetes Complications. 1996;10(4):339-345. doi:10.1016/S1056-8727(96)00036-4

8) Mahajan S, Koranne RV, Sharma SK. Cutaneous manifestations of diabetes mellitus. Indian J Dermatol Venereol Leprol. 2003;69(2):105-108.

9) Smith AG, Singleton JR. Impaired glucose tolerance and neuropathy. Neurologist. 2008;14(1):23-29. doi:10.1097/NRL.0b013e31815cffae

10) Arad Y, Roth M, Goldberg RB. Dermatoses in diabetes mellitus. Endocrinol Metab Clin North Am. 1999;28(4):1017-1035. doi:10.1016/S0889-8529(05)70132-0

11) Hahler B. An overview of dermatological conditions commonly associated with the diabetic patient. Ostomy Wound Manage. 2006;52(4):50-60.

12) Sawhney M, Talukdar KK, Bansal M, Kumar A. Cutaneous manifestations of diabetes mellitus: a clinical study. Indian J Dermatol Venereol Leprol. 1997;63(4):234-237.