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FACTORS ASSOCIATED WITH DIABETIC FOOT ULCERS AMONG PATIENTS AT SAIDU GROUP OF TEACHING HOSPITAL, SWAT: ANALYTICAL CROSS-SECTIONAL STUDY

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ABSTRACT

Background: *Diabetic foot ulcers (DFUs) are one of the most serious complications of diabetes mellitus, often leading to infection, amputation, and increased mortality. Understanding the factors associated with DFU severity is crucial for effective prevention and management.*

Aim: *To assess the relationship between glycemic control, foot self-care practices, neuropathy, and socioeconomic and demographic factors with the severity of diabetic foot ulcers.*

Methods: *A cross-sectional analytical study was conducted among 110 diabetic patients diagnosed with DFUs. Participants were categorized into mild (n=30), moderate (n=50), and severe (n=30) DFU groups based on clinical assessment. Data were collected on age, gender, education, socioeconomic status, glycemic control (HbA1c), foot self-care behaviors, and neuropathy (assessed via monofilament test). Statistical analysis included chi-square tests to evaluate associations, with $p<0.05$ considered significant.*

Results: *Severe DFUs were significantly more common in patients aged <50 years (50%, $p=0.008$), uneducated (100%, $p=0.002$), and from lower socioeconomic classes (70%, $p=0.04$). Poor glycemic control (HbA1c >8%) was present in 90% of severe cases ($p<0.001$), while inadequate foot self-care and neuropathy were also significantly associated with severity ($p<0.001$ and $p=0.001$, respectively). Gender was not significantly related to DFU severity ($p=0.32$).*

Conclusion: *The severity of diabetic foot ulcers is strongly influenced by modifiable factors such as glycemic control, foot care practices, and neuropathy screening. Educational and preventive strategies are essential, particularly among socioeconomically disadvantaged patients, to reduce DFU-related complications.*

Keywords: *Diabetic foot ulcer, Glycemic control, Neuropathy, Foot self-care, Socioeconomic status, Education,*

INTRODUCTION

Diabetic foot ulcer (DFU) can be defined as open sores or wounds famous in about 15-25 of patients with Diabetes Mellitus (DM) in a lifetime. The key terms used in the current paper include Diabetes Mellitus (DM), a long-lasting metabolic disturbance that is connected to increased glucose levels in blood; Peripheral Neuropathy (PN), or nerve damage caused by the persistence of hyperglycemia; Peripheral Artery Disease (PAD) is the impairment of arteries that leads to a diminished activity of blood circulation in the limbs; and WIFI classification, or a system that is used to monitor the severity of wounds, ischemia, and foot infections Such complications do

deteriorate DFU into one of the crucial issues of diabetic management and outcomes (Dwivedi & Pandey, 2020; Grennan, 2019; Gallagher et al., 2024).

Diabetes and its complications have been rising tremendously all around the world. According to the predictions of the International Diabetes Federation, in 2045, the number of people with diabetes will be comprised of 700 million, and around 34% of them will experience DFUs at one point (Miranda et al., 2021; Nawaz et al., 2024). The highest prevalence of DFU among diabetic patients is 13 percent in the US, 13.6 percent in Ethiopia, and 7.2 percent in Africa, whereas, it has alarming values in Pakistan where the prevalence is 10.4 percent in Faisalabad and as high as 61.4 percent in Hayatabad Medical Complex, Peshawar (Hussain et al., 2022; Aslam et al., 2023). Also, there is a risk of the appearance of a new ulcer within one year of recovery of an old one, equal to 42% (Armstrong et al., 2023).

The pathophysiology of DFU is multifactorial. Chronic hyperglycemia causes nerve injury (DPN) and ischemia which in association with impairment of protective sensation leads to foot deformities and decreased circulation (van Netten et al., 2024). PN compromises the integrity of the skin and thus is difficult to detect and PAD impedes the healing of wound. Minor cuts or wounds (blisters, calluses) could evolve to deep ulcers that in case of no treatment can result in infection, osteomyelitis, gangrene, and eventually, the amputation of the limb (Grennan, 2019; McDermott et al., 2023).

The complications of untreated DFUs do not end with wound damage around the local area but include hospitalization and systemic infections. DFU causes a high economic cost because of long treatments and surgery as well as therapy. DFUs generate the most diabetes-related hospitalization and contribute to 85 percent of all diabetes-related lower-limb amputations (Antar et al., 2023; Panigrahi & Majumdar, 2023). The burden is even greater in Pakistan, where the healthcare infrastructure is taxed, clinically and economically (Khan et al., 2023).

To determine the severity of conditions of diabetic feet, mainly, such classification systems as Wagner and WIFI are widely employed. Ulcers can be classified according to the Wagner system that can range in Grade 0 (intact skin) to Grade 5 (extensive gangrene) and by the WIFI classification that assesses wound depth, ischemia and infection that can be used to guide treatment and amputation risk (Ahmad et al., 2021; Armstrong et al., 2023). A WIFI of 3 or 4 shows that there is a high risk of amputation and therefore early detection and treatment are necessary (Gallagher et al., 2024).

Different demographic and lifestyle-related risk factors have been associated with the occurrence of DFUs. They are age of more than 60 years, female gender, the absence of education, lower socioeconomic status, a housewife or a laborer, smoking, obesity, and physical inactivity (Silva-Tinoco et al., 2024; Akhtar et al., 2022; Banik et al., 2020). The most susceptible patients include those with poor glycemic control, chronic diabetes, and an insufficient education on foot care (van Netten et al., 2024; Khan et al., 2023). All these factors together tend to result in late diagnosis and poor outcomes.

Although there exists improvement in the world in managing diabetics, there are still gaps in defining and attacking issues unique to the region. Perhaps, in Swat, Pakistan, culture, economic, and healthcare barriers are likely to affect the treatment of diabetic foot complications. Thus, the paper was completed at the Saidu Group of Teaching Hospital to determine the local factors of DFUs and measure their severity in order to provide information that may inform the local foot care policy and intervention efforts (Hussain et al., 2022; Vahwere et al., 2023).

Methodology

The study was designed as an analytical cross-sectional study. It was conducted at Saidu Group of Teaching Hospital, a tertiary care facility located in Swat. The purpose was to investigate factors associated with diabetic foot ulcers among patients attending the diabetic foot clinic and admitted in medical wards.

Data Collection Procedure

A total of 110 patients were selected using non-probability convenience sampling. The sample size was calculated using the Raosoft online sample size calculator at a 95% confidence interval and 5% margin of error. The study included patients diagnosed with diabetic foot ulcers. Patients with foot ulcers due to non-diabetic causes were excluded. Data were collected over a three-month period from June 1st to August 30th, 2024. A structured questionnaire adapted from Van Netten

et al. (2024) was used for data collection. The questionnaire included demographic details, medical history, hygiene practices, blood sugar control, neurological and vascular factors, lifestyle behaviors, and knowledge about foot care. Informed written consent was obtained from all participants. Ethical approval and institutional permission for data collection were granted.

Data Analysis Procedure

The collected data were entered, coded, and analyzed using the Statistical Package for the Social Sciences (SPSS) version 22.0. Descriptive statistics such as frequencies, percentages, means, and standard deviations were calculated to summarize the demographic characteristics and clinical variables of the study participants.

Cross-tabulation was conducted to examine the relationship between selected demographic variables (age, gender, education, occupation, marital status, and socioeconomic status) and the severity of diabetic foot ulcer-related factors. Severity was categorized into mild, moderate, and severe based on predefined clinical criteria.

Chi-square tests were used to assess the statistical significance of associations between categorical variables. A p-value of less than 0.05 was considered statistically significant. The results were presented in the form of tables and figures to enhance clarity and interpretation.

Results and Analysis

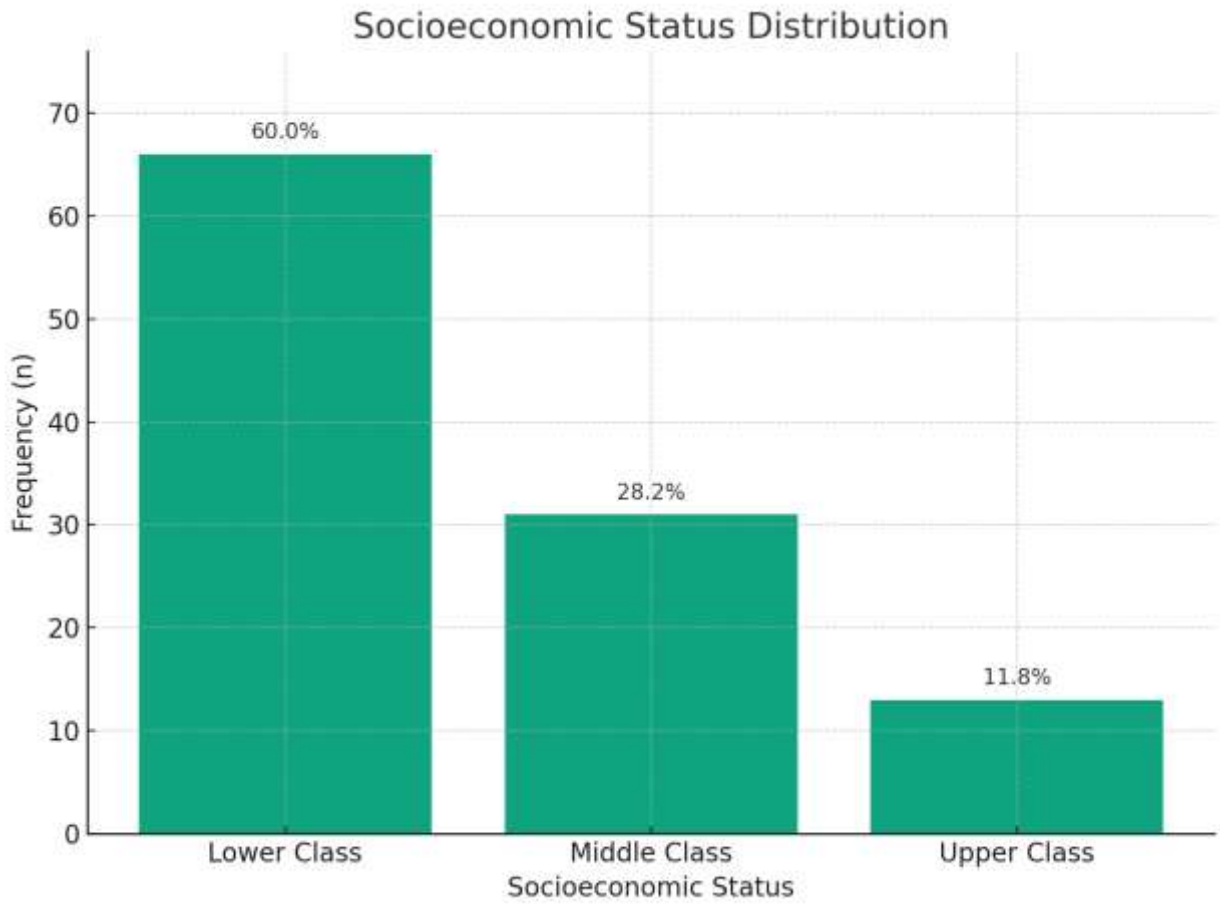
Demographic Analysis

The majority of respondents were over 60 years old (45.5%), predominantly female (76.4%), and had no formal education (93.6%). Most were married (99.1%) and identified as housewives (75.5%). A significant portion belonged to the lower socioeconomic class (60.0%). Overall, the data reflects a largely older, uneducated, and economically disadvantaged female population.

Table 1: Demographic Characteristics of Study Participants (N = 110)

Variable	Category	Frequency (n)	Percentage (%)
Age Group	<30 years	1	0.9%
	31–40 years	5	4.5%
	41–50 years	29	26.4%
	51–60 years	25	22.7%
	>60 years	50	45.5%
Gender	Male	26	23.6%
	Female	84	76.4%
Education Level	Educated	7	6.4%
	Uneducated	103	93.6%
Marital Status	Married	109	99.1%
	Unmarried	1	0.9%
Occupation	Government Job	6	5.5%
	Housewives	83	75.5%
	Labour	21	19.1%
Socioeconomic Status	Lower Class	66	60.0%
	Middle Class	31	28.2%
	Upper Class	13	11.8%

Figure 1: Distribution of Participants by Socioeconomic Status



The figure 1 illustrates that the majority of participants (60%) belonged to the lower socioeconomic class. Fewer participants were from the middle (28.2%) and upper (11.8%) classes.

Association Between Sociodemographic Factors and DFU Severity

The severity of diabetic foot ulcers (DFU) showed a significant association with age, education level, and socioeconomic status. Severe DFU was more common in younger patients (<50 years: 50%, p=0.008) and those from lower socioeconomic backgrounds (p=0.04). Education level significantly declined with increasing DFU severity (p=0.002), with no educated individuals in the severe category. Gender distribution did not show a significant difference across DFU severity levels (p=0.32).

Table 2: Association Between Sociodemographic Factors and DFU Severity (Based on Chi-square tests, n=110)

Variable	Category	Mild DFU (n=30)	Moderate DFU (n=50)	Severe DFU (n=30)	p-value
Age Group	<50 years	10 (33.3%)	10 (20.0%)	15 (50.0%)	0.008
	≥50 years	20 (66.7%)	40 (80.0%)	15 (50.0%)	
Gender	Male	10 (33.3%)	10 (20.0%)	6 (20.0%)	0.32
	Female	20 (66.7%)	40 (80.0%)	24 (80.0%)	
Education Level	Educated	5 (16.7%)	2 (4.0%)	0 (0.0%)	0.002
	Uneducated	25 (83.3%)	48 (96.0%)	30 (100.0%)	
Socioeconomic Status	Lower Class	15 (50.0%)	30 (60.0%)	21 (70.0%)	0.04
	Middle/Upper	15 (50.0%)	20 (40.0%)	9 (30.0%)	

Clinical and Behavioral Factors Associated with DFU Severity

Severe diabetic foot ulcers (DFUs) were significantly associated with poor glycemic control, with 90% of severe cases having HbA1c >8% (p<0.001). Inadequate foot self-care was reported by 86.7% of severe cases compared to 50% in non-severe cases (p<0.001). Neuropathy was more prevalent in severe DFU patients (93.3%) than non-severe (62.5%), showing a significant association (p=0.001). These findings highlight the importance of glycemic control, foot care, and neuropathy screening in DFU prevention.

Table 3: Clinical and Behavioral Factors Associated with DFU Severity

Factor	Category	Severe DFU (n=30)	Non-Severe DFU (n=80)	p-value
Glycemic Control	HbA1c >8%	27 (90.0%)	45 (56.3%)	<0.001
(HbA1c levels)	HbA1c ≤8%	3 (10.0%)	35 (43.7%)	
Foot Self-Care	Inadequate	26 (86.7%)	40 (50.0%)	<0.001
(Daily inspection/washing)	Adequate	4 (13.3%)	40 (50.0%)	
Neuropathy	Present	28 (93.3%)	50 (62.5%)	0.001
(Monofilament test)	Absent	2 (6.7%)	30 (37.5%)	

Discussion

Our study shows that patients with age between 41-50 years, experienced moderate factors 23.6% while mostly patients with age above 60 years experienced severe factors 30.9% with mean age 50 years. These findings are in accordance with a study conducted in Pakistan (Khyber Pakhtunkhwa 2021), which shows that most commonly affected age group was 41-70 years (23-30%) with mean age 56.85 years. In our study most of females had experienced severe factors 49.0% and males experienced moderate factors 20.9%. These findings are in congruence with study of Pakistan journal of health science (Hussain, F., et al., 2022), which reports that 52.2% females and 47.8% males were affected. Also found in study of BMC public health (Vahwere, B. M., et al, 2023) majority were females, 61.5% and males 38.5%, sex was significantly associated with the severity of DFU (Hussain et al 2025),

According to the education level of respondents in our study, most of them were uneducated about moderate factors, 42.7% and severe factors, 50.9%. In favor of this study according to (Khan, Z., et al.,), educated persons were 41.69% and uneducated persons were 58.31%. Educated person know more about diabetes complications and can handle it better compared to illiterate person. In our finding's, married people were suffered from moderate factors 47.2% and severe factors 50.9%. In similarity of this study, according to study conducted in Saudi Arabia (2024), 78% were married, 22% were unmarried and affected.

In our study, most of the housewives were affected by severe factors 49.0%, laborer by moderate factors 17.2% and government job employees affected by mild factors 0.9%. In accordance to this study, a study conducted in Pakistan, Faisalabad (2022), which shows that 49.6% were housewives, 8.6% were government job employed, and 15.8% were laborers affected. In our study most of respondents according to socioeconomic status were lower class and mostly affected by moderate factors 34.5% and severe factors 25.4%. In congruence of this study of Pakistan Faisalabad (2022), which shows that 36.6% people from lower class were affected.

Conclusion

The study highlights that severe diabetic foot ulcers are significantly associated with poor glycemic control, inadequate foot self-care, presence of neuropathy, low education levels, and lower socioeconomic status. The findings underscore the urgent need for early screening, patient education, and improved diabetes management to reduce the severity and complications associated with DFUs.

Recommendations

1. **Strengthen Patient Education:** Implement structured education programs focusing on glycemic control, foot hygiene, and self-care practices for diabetic patients, particularly targeting uneducated and lower-income groups.
2. **Routine Neuropathy Screening:** Incorporate regular monofilament testing in primary care settings to detect neuropathy early and prevent DFU progression.

3. **Enhance Access to Care:** Improve accessibility to podiatric and diabetes care services for socioeconomically disadvantaged populations.
4. **Community-Based Interventions:** Deploy outreach programs involving nurses and community health workers to promote foot care awareness at the household level.
5. **Policy and Resource Allocation:** Advocate for policies that support subsidized diabetic supplies, such as glucose monitors and footwear, for patients from low-income backgrounds.

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