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**Original Article**

# Diabetic Foot Ulcers: Prevalence and Associated Risk Factors among Diabetic Patients

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## ABSTRACT

Diabetes Mellitus, a complex disease, chronic in nature; requires uninterrupted care to reduce various risk factors beyond glycemic control. **Objective:** To find out prevalence of foot ulcers among diabetic patients and identification of risk factors that can lead to the development of ulcers among diabetic patients attending the tertiary care centers of Faisalabad. **Methods:** A cross sectional survey was conducted on 500 diabetic patients attending the diabetic clinics. Subjects were identified using non-probable convenient sampling and data was collected by using structured questionnaire. Associated risk factors of diabetic foot ulcers were all assessed. Using SPSS version 23.0 for windows software, data were managed and analyzed. **Results:** There were n=239 males and n=261 females. Most of the patients were in the age group of 61-70. Major population belonged to middle socio-economic status (46.2%). Diabetic foot ulcer prevalence was 10.4%. There was significant association between ulcer and age ($p$=.036), gender ($p$<.001), lifestyle of patient ($p$=.003), BMI of Patient ($p$=.001), smoking habits ($p$<.001), duration of diabetes ($p$<.001), and family history of diabetes ($p$<.001)**. Conclusions:** The study concluded that 10.4% of diabetic patients had foot ulcers. Diabetic foot ulceration was significantly related with male gender. It is thus recommended that diabetic care providers can reduce the prevalence of diabetic foot ulcers by increasing understanding of the disease and foot care examination among those having sensory loss.

## INTRODUCTION

Diabetes Mellitus, a complex disease, chronic in nature; requires uninterrupted care to reduce various risk factors beyond glycemic control. It needs regular medical screening and treatment strategies along with multifaceted risk management techniques beyond the glycemic control [1]. The life expectancy of people with diabetes has decreased by up to fifteen years, and seventy five percent patients die of macro-vascular complications [2]. 1.5 million new diabetic cases were reported in U.S having age of 18 years or older in 2015 [3]. Type-I diabetes has been reported in about 5-10 % of all diabetes and has many serious indications [4]. Whereas type-II diabetes covers about 85-95 % of all diabetic cases in developed countries [5]. The prevalence of diabetes would be around 67 % in developing countries between 2010 and 2030 [6]. It is also stated that children have higher rates of prevalence and incidence of type 2 diabetes [7]. Although there are a number of complications which effects patient's life, but complications related to feet are more devastating. In most of the developing countries, Diabetic Foot ulcer (DFU) is among the major complication which can lead to disability [8]. Foot complications due to diabetes consist of lesions within deep tissues and are also found in association with neurological deficits and vascular pathologies of lower extremities. Prevalence of Diabetic Peripheral Neuropathy (DPN) ranges between 16 and 66 percent [9]. Leading causes of lower extremity complications are ulcers related to diabetes and its resulting problems which includes

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infections, gangrene and osteomyelitis [10]. If ulceration is neglected and not treated promptly than foot amputation is the only option that can be opted. As a result, there is distorted body image that may lead to loss of employment, dependency on others, impacts the finances and psychology of the patient [11]. In diabetic foot ulcers a wound near ankle is prevalent which encompass the full thickness of skin, regardless of its time period it is associated to peripheral atrial disease or neuropathy of lower limb [12]. DFU is one of the usual presentations of diabetic foot. The diabetic foot come under a group of syndromes in which tissue breakdown occurs due to infection, ischemia and neuropathy, that results in the risk of permanent morbidity and possibly amputation [13]. Foot complications lead to foot osteomyelitis when not treated for long time period [14]. Prior history of foot ulcers, neuropathy and deformities are among the risk factors responsible for foot ulceration. The other potential factors that set a person at risk of developing DFU includes older age, male gender, diabetes for a long time, poor glycemic control, renal disease, hypertension, diabetic retinopathy, peripheral vascular disease, poor knowledge of diabetic foot wear, high body mass index (BMI), poor blood circulation and smoking [15, 16]. To prevent the complications like diabetic foot, it is very essential that the patient should go for regular checkup and proper and adequate treatment [17]. It is known that the patients with diabetes mellitus are at increased for the development of ulcers so it is a major health concern that was a major reason behind this study. Thus, current study was focused to reveal the prevalence and its associated risk factors of foot ulcer among diabetics.

## METHODS

This cross-sectional study was conducted in tertiary care centers of Faisalabad. For the survey a sample size of 500 diabetic patients was taken by using Epi Tool. A questionnaire based on earlier studies was used to record data attained from the medical records and interviewing the patients [18]. Non-Probability convenient sampling was used to identify male and female participants with age >19years, with any type of diabetes and willing to participate. Patients with traumatic ulcers, systemic illnesses, mental disorders were excluded. The data was collected using questionnaire aimed on demographics, diabetes mellitus history and risk factors, foot ulcers history and also using Wagner classification for measuring the location and depth of ulcers. Using SPSS-23 for windows software, data was managed and analyzed. The quantitative data was presented on form for frequency table and bar chart was used to show summary of measurements.

## RESULTS

There were 1.9% of the participants below 40 years, 7.6% were between 41-50 years age group, 9.1% were between 51-60 years,18.9% were between 61-70 years and 12.9 % were >70 years old. There were 47.8% (n=239) males and 52.2% (n=261) females. Among total, 3% (n=15) were single and 97% (n=485) were married. 10.8% (n=54) were businessman, 8.6% (n=43) had government jobs, 15.2% (n=76) had private jobs, 15.8% (n=79) were unemployed and 49.6% (n=248) were housewives among them. Regarding their socioeconomic status, 36.6% (n=183) had low socioeconomic status, 48.8% (n=244) had middle socioeconomic status and 14.6% (n=73) belonged to upper class. Lifestyle of patients showed that 47.6% (n=238) were having sedentary lifestyle and 52.4% (n=262) were active. Educational level of patient showed that there were 33% (n=165) illiterate, 10.2% (n=51) had primary level education, 6 % (n=30) had elementary level education, 26.6 % (n=133) were having matriculation level education, 24.2% (n=121) had higher level of education. Considering the Body Mass Index, 1% (n=5) were underweight, 44% (n=223) were having normal weight, 45.6% (n=228) were overweight, 8.8% (n=44) were obese. 7.6% (n=38) were current smoker and ex-smoker were 20.8% (n=104) while 71.6% (n=358) were non-smoker (Table 1).

| Variables | Number (%) |
|---|---|
| **Age** | |
| <40 | 1 (1.9%) |
| 41-50 | 7 (7.6) |
| 51-60 | 18 (18.9%) |
| 61-70 | 18 (18.9%) |
| >70 | 8 (12.9%) |
| **Gender** | |
| Male | 239 (47.8%) |
| Female | 261 (52.2%) |
| **Marital Status** | |
| Single | 15 (3.0%) |
| Married | 485 (97%) |
| **Occupation of Patient** | |
| Businessman | 54 (10.8%) |
| Government Job | 43 (8.6%) |
| Private job | 76 (15.2%) |
| Unemployed | 79 (15.8%) |
| House wife | 248 (49.6%) |
| **Socio-Economic Status** | |
| Lower SES | 183 (36.6%) |
| Middle SES | 244 (48.8%) |
| Upper SES | 73 (14.6%) |
| **Lifestyle of Patient** | |
| Sedentary | 238 (47.6%) |
| Active | 262 (52.4%) |
| **Educational Level of Patient** | |
| Illiterate | 165 (33.0%) |
| Primary | 51 (10.2%) |
| Elementary | 30 (6%) |

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| | |
|---|---|
| Matric | 133 (26.6%) |
| Higher | 121 (24.2%) |
| **BMI of Patient** | |
| Underweight | 5 (1.0%) |
| Normal | 223 (44.6%) |
| Overweight | 228 (45.6%) |
| Obese | 44 (8.8%) |
| **Smoking Habits** | |
| Current smoker | 38 (7.6) |
| Ex-Smoker | 104 (20.8%) |
| Non Smoker | 358 (71.6%) |

**Table 1:** Demographic Data of the Subjects

The results of the current study showed that there were significant association of age with foot ulcers p=.036. Results also revealed that there was statistically significant association between gender and ulcer prevalence with p value <.001. Majority of males (80%) were having ulcers as compared to females 19.2%. Occupation of the patient showed that (13.5%) of the businessman, (11.5%) of participants with government job, (17.3%) having private job, (40.4%) of the unemployed and (17.3%) housewives had ulcer. Chi square showed significant association between occupation and ulcer with p value <.001. Majority of unemployed showed greatest association. Lifestyle of patient showed that there were 203(45.3%) sedentary and 245(54.7%) active patients with no ulcer. 35 sedentary subjects and 17 active patients had ulcer. Chi square test revealed association between lifestyle and ulcer with p value<.005(p -value 0.003). Of the total, 27 overweight patients had ulcer. This indicated significant association with p value = .001. Chi square test showed that there was no association among marital status, socioeconomic status and educational level of the patient (Table 2).

| Variables | No ulcer Frequency (%) | Ulcer Frequency (%) | p-value |
|---|---|---|---|
| **Age** | | | |
| <40 | 25 (46.3%) | 1 (1.9%) | 0.036 |
| 41-50 | 39 (42.4%) | 7 (7.6%) | |
| 51-60 | 97 (49.2%) | 18 (9.1%) | |
| 61-70 | 34 (35.8%) | 18 (18.9%) | |
| >70 | 29 (46.8%) | 8 (12.9%) | |
| **Gender** | | | |
| Male | 197 (44.0%) | 42 (80.8%) | <.001 |
| Female | 251 (56.0%) | 10 (19.2%) | |
| **Marital Status** | | | |
| Single | 13 (2.9%) | 2 (3.8%) | 0 .706 |
| Married | 435 (97.1%) | 50 (96.2%) | |
| **Occupation of Patient** | | | |
| Businessman | 47 (10.5%) | 7 (13.5%) | <.001*** |
| Government Job | 37 (8.3%) | 6 (11.5%) | |
| Private job | 67 (15.0%) | 9 (17.3%) | |
| Unemployed | 58 (12.9%) | 21 (40.4%) | |
| House wife | 239 (53.3%) | 9 (17.3%) | |
| **Socio-Economic Status** | | | |
| Lower SES | 160 (35.7%) | 23 (44.2%) | |
| Middle SES | 220 (49.1%) | 24 (46.2%) | 0.369 |
| Upper SES | 68 (15.2%) | 5 (9.6%) | |
| **Lifestyle of Patient** | | | |
| Sedentary | 203 (45.3%) | 35 (67.3%) | 0.003** |
| Active | 245 (54.7%) | 17 (32.7%) | |
| **Educational Level of Patient** | | | |
| Illiterate | 147 (32.8%) | 18 (34.6%) | 0.098 |
| Primary | 44 (9.8%) | 7 (13.5%) | |
| Elementary | 23 (5.1%) | 7 (13.5%) | |
| Matric | 122 (27.2%) | 11 (21.2%) | |
| Higher | 112 (25.0%) | 9 (17.3%) | |
| **BMI of Patient** | | | |
| Underweight | 2 (.4%) | 3 (5.8%) | 0 .001** |
| Normal | 202 (45.1%) | 21 (40.4%) | |
| Overweight | 201 (44.9%) | 27 (51.9%) | |
| Obese | 43 (9.6%) | 1 (1.9%) | |
| **Smoking Habits** | | | |
| Current smoker | 33 (7.4%) | 5 (9.6%) | <.001** |
| Ex-smoker | 81 (18.1%) | 23 (44.2%) | |
| Non smoker | 334 (74.6%) | 24 (46.2%) | |

**Table 2:** Risk Factors related to the Development of Ulcers among diabetics

## DISCUSSION

The study findings revealed that the prevalence of diabetic foot ulcer in diabetics was 10.4% in tertiary care centers of Faisalabad. Comparable results were presented by Iversen, according to which the prevalence of foot ulcers in Norway was 10.4% [19]. Furthermore, a study directed in southern Ethiopia reported a prevalence of 14.8% for diabetic foot ulcers. Contrasting to the current study results, the Jordanian study reported less prevalence 4.6% [18]. According to existing study, 80.2% of diabetic foot ulcers were found in males (n = 42), compared with 19.2% of females (n = 10), signifying that the majority of males in this study compared to females had an ulcer. The result of the study was also supported by another study in southern Ethiopia, which displayed that 62.5% of men and 37.5% of women had diabetic foot ulcers [20]. Contradictory results were found in a study where DFU was more prevalent among women (58.2%) in comparison to men (41.8%). Likewise, Khan et al., reported that prevalence was considerably higher in women (56.1%) than in men (43.9%) attending primary health care centers at Saudi Arabia [21]. Statistically significant association (p-valve is <0.001) was found between prevalence of the ulcers in diabetics and body mass index (BMI). Findings revealed that 51.9% (n = 27) of overweight diabetic patients were more probable to ulcer than those with a normal body weight of 40.4% (n = 21).The findings of this study were also supported by studies in Ethiopia and Kenya. Findings of these studies revealed that there was 2.1 times more chances of development of ulcers among over-weight patients [8]. Current study also found that type of diabetes and

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development of foot ulcers was not associated. The study conducted in Egypt also found that reported similar results [22]. The conclusions of current study determined that patients with extended history of diabetes mellitus were at higher risk for diabetic foot ulcers. This finding is alike to preceding studies in northern India, which revealed that diabetic patients > 10 years of age had ulcers eight times more often than patients under ten years of age [23, 24]. Our study found that the family history has a clear effect on the development of foot ulcers. The result of our study is supported by the other study conducted Chavan [25]. Patients with ulcer history may be susceptible to microvascular and macrovascular complications. In this study, patients with microvascular complications were found more prone to developing a diabetic foot ulcer. Neuropathy is an identified risk factor for the development of a foot ulcer. The results of this study are relatable to study carried out in Iran [26]. Amputation, retinopathy after diabetes and kidney disease was significantly associated with foot ulcer. A study conducted among diabetics in Kenya shows that diabetics with comorbidities are 7.8 times more susceptible to foot ulcers than patients without comorbidities [20].

## CONCLUSIONS

Current study concluded that significant number of patients was found with foot ulcers. Diabetic foot ulcer was significantly associated with many of the risk factors.

### Conflicts of Interest

The authors declare no conflict of interest

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