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### Risk Factor Prevalence Among Diabetic Foot Ulcers Patients in Babylon Province: A Cross - Sectional Study

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**Abstract:**

**Background:** Diabetic foot ulcers (DFUs) are one of the most prevalent and dangerous consequences of diabetes, particularly in the context of peripheral neuropathy or peripheral vascular disease. Diabetics have a weaker immune system, and the ulcer-producing foot is easily infected, difficult to treat, and has a poor prognosis. **Aim:** Determine the prevalence of diabetic foot ulcers among diabetic patients in Babylon, Iraq, and how it relates to the patients' sociodemographic and lifestyle characteristics. This study's factors include gender, age, diabetes duration, smoking habits, cardiovascular disease, diabetic neuropathy, nephropathy, and retinopathy, as well as treatment and family history of foot ulcers. **Method:** Data were obtained from patients who came to the hospital to reveal their medical condition by asking the patient a series of questions directly or indirectly, using a specialized questionnaire form. **Results:** The Diabetic Foot Ulcers (DFUs) were in males more than in females, the prevalence of DFUs is greater among patients aged 55-64 years. patients with disease duration of longer than 10 years and those using insulin in their anti-diabetic regimen as important factors associated with DFU occurrence. The DFU frequency in smokers was higher than in non-smokers. The prevalence of diabetic peripheral neuropathy (DPN) and coronary artery disease (CAD) as risk factors for developing DFU. Grade -2 more than other grades due to the possible interpretation of these results is that rural dwelling promotes poor foot care practice and barefoot walking. **Conclusion:** Diabetic foot ulcers are a serious complication of diabetic disease, and they are more common among diabetic patients who are overweight, and have a family history of diabetic foot ulcers. Diabetic foot ulcers require targeted therapies and significant efforts to avoid their onset, facilitate early detection, effectively control diabetes, and change associated risk factors.

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## 1. Introduction

Diabetes mellitus (DM) is a persistent inflammatory condition linked to both small blood vessel and large blood vessel problems, which are recognized as significant contributors to illness and death. The primary hazardous consequence of this condition is the development of chronic sequelae, particularly microvascular diseases such as diabetic retinopathy, nephropathy, foot disease, and neuropathy. Diabetic microvascular problems arise because of chronic inflammatory processes (1). Diabetic foot ulcers (DFUs) are prevalent and severe consequences of diabetes that result from long-term high blood sugar levels. In addition, diabetes can result in vascular disease and disrupt the delivery of nutrients through the blood supply, perhaps leading to ischemia and an increased susceptibility to ulcers. Patients experiencing a loss of feeling and reduced metabolic response are unable to react to recurrent stress and trauma on their plantar tissues, resulting in skin deterioration and lesions (2). The development of DFU is influenced by multiple factors. Diabetic foot ulcers develop due to the intricate interplay of variables, including peripheral artery disease, atherosclerotic plaque, alterations in the microcirculation, and peripheral neuropathy (3). Factors that increase the likelihood of persistent ulcers include a longer length of the wound, a higher number of ulcers, the presence of infection, a more advanced Wagner stage, the older age of the patient, undergoing dialysis therapy, and having peripheral vascular disease (4). The Wagner-Meggitt system is a widely accepted and commonly used classification system for evaluating diabetic foot lesions. It categorizes DFUs based on the depth of ulceration and extent of gangrene. However, it does not consider important clinical factors such as ischaemia, infection, and other comorbidities. The system consists of six grades (five). There is ample information about the management of DFUs, which emphasizes the importance of maintaining controlled blood sugar levels and providing regular wound care to every patient. Conventional wound care involves removing

dead tissue from the wound, relieving pressure on the wound, maintaining the right level of moisture with suitable dressings, managing swelling, and preventing infection. The blood circulation to the wound or extremities should be sufficient (6).

Several studies have shown that proper management of diabetic foot ulcers (DFU) can greatly reduce, delay, or prevent complications such as infection, gangrene, amputation, and death (7).

## **2. Patients and Methods**

Our work is a cross-sectional study conducted from March 1, 2022, to the conclusion of October 2022. A total of 288 individuals participated in the study. Among them, 96 had diabetic foot ulcers, another 96 had type 2 diabetes mellitus, and the remaining 96 were healthy persons who served as the control group. The study included individuals who were diagnosed at the Diabetic Clinic and Endocrine Center in Marjan Medical City, Imam Al-Sadiq Hospital, and AL-Hashimiyah General Hospital in Babylon Province .

### **Data collections**

Data were gathered subsequent to obtaining information from patients at the hospital. This was accomplished by directly or indirectly posing a series of inquiries to the patient on their living conditions and socio-demographic information. The study incorporates characteristics such as gender, age, duration of diabetes, smoking habits, cardiovascular disease, Diabetic neuropathy, nephropathy, and retinopathy, as well as the medication employed and family history of foot ulcers.

### Statistical techniques

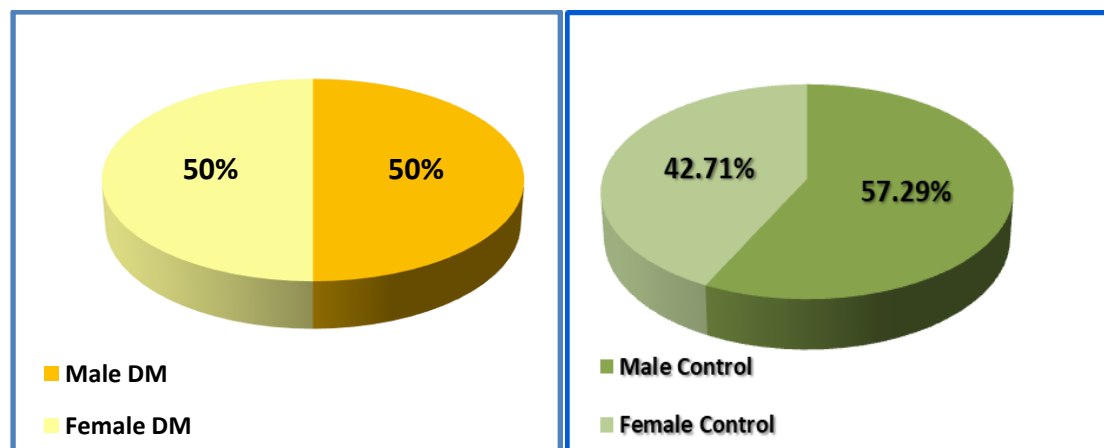
The statistical analyses were conducted using SPSS version 26. The data was expressed as the mean plus or minus the standard deviation. The normality of the distribution of all variables was assessed using the ANOVA test, while Pearson correlation analysis.  $P < 0.05$  deemed to demonstrate statistical relevance. Outliers were excluded from the results.

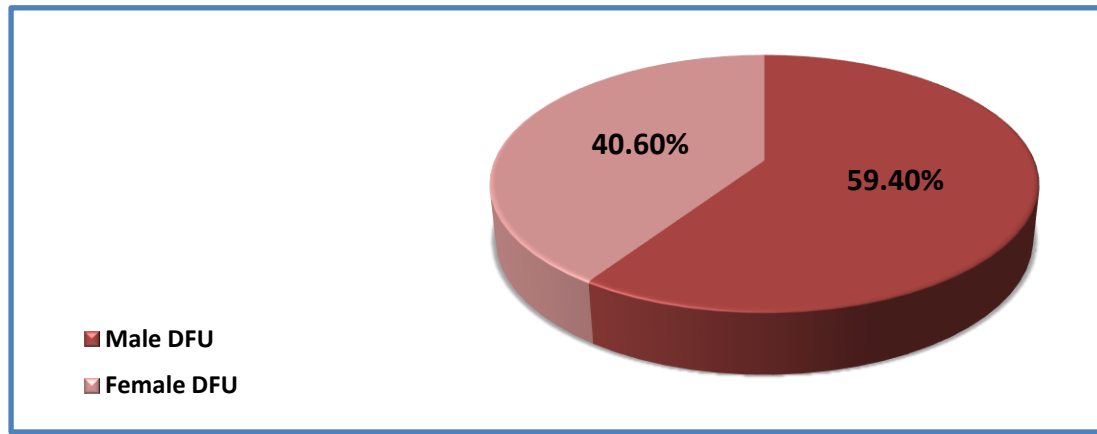
## 3. Results:

### 3.1 Distribution of sex in the study groups

Among the patients with T2DM who contributed to this study, there were 50 % females and 50 % males, while DFU group comprised of 40.6 % females and 59.4 % males and control group comprised of 42.71 % females and 57.29 % males, as shown in Figure (1).

DFU was higher in male patients compared to female patients, with a rate of 59.4% for males and 40.6% for females. The data analysis reveals that male diabetes patients have a greater prevalence of diabetic foot disease is higher in male diabetic individuals compared to female patients.





**Figure-1. Gender distribution in T2DM , DFU and Control group**

### **3.2 Characteristics of patients with DFU and factors to be assessed**

Table (2) indicated a relationship between diabetic foot ulcer incidence and insulin use (53.1%), smoking (59.4%), Diabetic neuropathy (96.9%), Diabetic nephropathy (21.9%) and diabetic retinopathy were found in (96.9%) of participants with DFUs compared with patients without DFU .

Patients at risk for DFU aged 55 to 64 years had the highest frequency (43.8%) followed by those aged over 65 years (28.1%) and less than 50 (18.7%). Regarding the duration of DFU patients had been diagnosed with long-term diabetes, with disease duration more than 10 years 36.5% had a higher frequency than those with disease duration of 10 years or less than 5 years , compared to 3.1% of participants without DFUs. Table (2) revealed that most of the studied with regard to DFU risk factors. The frequency of DFUs was related to the type of medicine which was higher in individuals who took insulin (53.1 %) than in those who took oral hypoglycemic medications (46.9 %). The result of present study show 12.5% prevalence of coronary artery disease was higher in patients with diabetic foot ulcers (DFU), with a rate of 28.1% compared to patients without DFU.

### 3.3 Distribution of DFUs according to Wagner's classification.

In the current study Figure (2) showed the classification according to the Wagner's grades that demonstrate the number of DFU patients for each grade, mostly the patient that came the diabetic clinic and endocrine center in Marjan medical city, Imam Al-Sadiq hospital and AL-Hashimiyah general hospital . DFU (Grade -2) more than other grades due to the possible interpretation of these results is that rural dwelling promotes poor foot care practice and barefoot walking.

**Table-2 Comparison between diabetic patients with and without DFUs concerning socio demographic characteristics , medical data and lifestyle variables**

Medical data and life style variables	Patients With DFUs	Number of Patients	Patients Without DFUs	Number of Patients
<b>Age:</b>				
35-44	9.3%	9	9.4%	9
45-54	18.7%	18	25.0%	24
55-64	43.8%	42	47.0%	45
>65	28.1%	27	18.8%	18
<b>Duration of diabetes (yr):</b>				
>5	12.5%	12	34.4%	33
6-10	23%	22	50.0%	48
10-15	36.5%	35	12.5%	12
<15	28.1%	27	3.1%	3
<b>Smoking</b>				
Yes	59.4%	57	25%	24
No	40.6%	39	75%	72
<b>Diabetic neuropathy</b>				
Yes	96.9%	93	25%	24
No	3.1%	3	75%	72
<b>Diabetic nephropathy</b>				
Yes	21.9%	21	18.8%	18
No	78.1%	75	81.3%	78
<b>Diabetic retinopathy</b>				
Yes	96.9%	93	59.4%	57
No	3.1%	3	40.6%	39

<b>Coronary artery disease</b>				
<b>Yes</b>	12.5%	12	28.1%	27
<b>No</b>	87.5%	84	71.9%	69
<b>Diabetic medication:</b>				
<b>Insulin treatment</b>	53.1%	51	40.6%	39
<b>Oral anti diabetic medication</b>	46.9%	45	59.4%	57

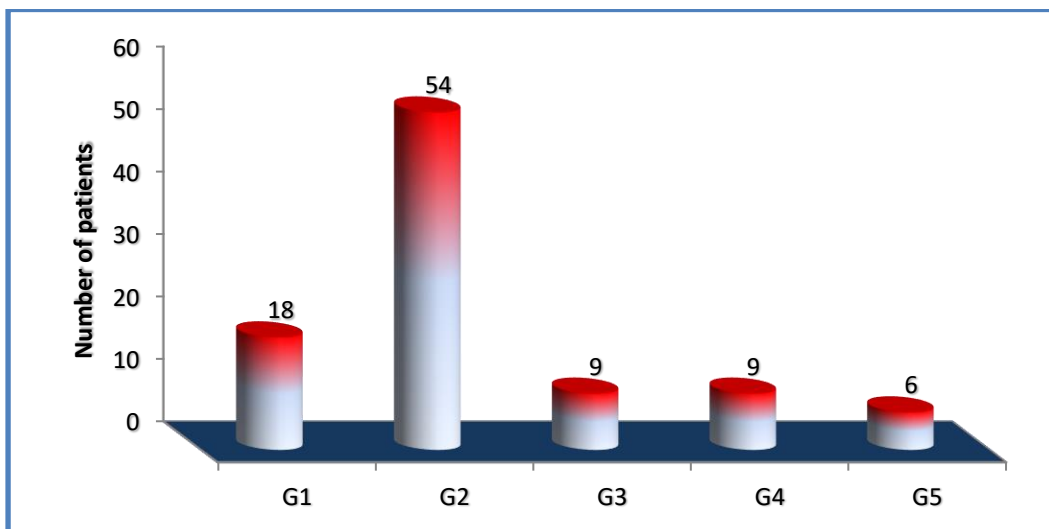


Figure-2 Classification of grade depended on number of DFU patient

#### 4. Discussion

##### The gender distribution within the groups under analysis

The data analysis reveals incidence of diabetic foot was more pronounced in male diabetes patients (59.4%) compared to female patients (40.6%). The findings of this study align with the research conducted by Malepati, S., et al. (8) and Anatoliy et al. (9), which demonstrated that males have a higher susceptibility to foot ulcers compared to females. One possible explanation for this gender difference could be the greater participation of males in physically demanding labor, which exposes them to more strenuous work and a higher risk of workplace injuries (8). According to Zhang P et al. (10), research



indicates that men are more susceptible to diabetic foot ulcers (DFU) due to a higher prevalence of risk factors such as smoking, peripheral vascular disease, inadequate glycemic control, limited joint mobility, and poor medication adherence.

### **Characteristics of DFU patients and factors to be evaluated**

The present study is to evaluate the risk factors associated with the development of diabetic foot ulcers (DFU) among individuals with diabetes in Babylon City. The prevalence of diabetic foot ulcers (DFUs) is higher (43.8%) among individuals in the age group of 55–64 years, making it a significant risk factor for DFUs. While age is a contributing factor to delayed healing in individuals with diabetic foot ulcers (DFU), these patients exhibited faster rates of healing and lower rates of mortality and severe amputation compared to older patients. Tong, T., *et al.* (11) identified several distinct risk factors in middle-aged patients with diabetic foot ulcers (DFUs). These included severe infection, living alone, current smoking, and having a high white blood cell count. Patients with these risk factors were more likely to have poor lifestyle and glucose control, an increased likelihood of microangiopathy as a complication, and tended to have larger and deeper ulcers. Elderly individuals with diabetes experience a prolonged duration of the condition, which is associated with several diabetes-related comorbidities and other chronic illnesses (12). The current study found that individuals who had been living with the condition for more than 10 years and those who were using insulin in their anti-diabetic treatment were identified as significant factors contributing to the formation of diabetic foot ulcers (DFU). There is a correlation between diabetic medication and the severity of DFU (13). Despite the lack of a clear explanation, it is believed that there is a stronger connection between insulin injection and the severity of diabetic foot ulcers (DFU). This association may be due to the body's inflammatory reaction. Insulin was administered to DFU

patients, but 40.6% of those without DFUs did not receive insulin treatment. Consistent with the findings of Yazdanpanah *et al.* (15), individuals who used insulin were shown to have a higher susceptibility to developing foot ulcers compared to those who used oral anti-diabetic medications. If diabetes in older individuals is not properly controlled and is leading to problems, treatment with insulin may be necessary. Tobacco use is a significant contributing factor to the development of diabetic foot ulcers (DFU) and peripheral vascular disease. The prevalence of DFU was 59.4% among smokers, which exceeded the prevalence among non-smokers (40.6%). Moreover, Obaid and Eljed (16) found that smoking elevates the risk of developing diabetic foot in individuals who do not smoke. During this analysis, it was found that smoking was a risk factor for 59.4% of the patients with diabetic foot ulcers (DFUs), which was higher compared to individuals with type 2 diabetes (DMT2). Galal *et al.* (17), Salama & Zorin (18), and Al Kafrawy *et al.* (12) all discovered that smoking posed a risk for diabetic foot ulcers, aligning with our own findings. The frequency of DFU was greater in patients with diabetes-related problems compared to those without difficulties. In the case of diabetic foot ulcers (DFU), the occurrence of diabetic nephropathy was 21.9%, and diabetic retinopathy (DR) was 96.9%. Within the study group, the occurrence rate of diabetic peripheral neuropathy (DPN) considered a determinant of risk that increases the likelihood of developing DFU was 96.9%, while the occurrence rate of coronary artery disease (CAD) was 12.5%. Furthermore, individuals with diabetes have an increased likelihood of developing foot ulcers due to peripheral neuropathy, foot abnormalities, minor foot injuries, and peripheral artery disease. The chronicity of DFUs is influenced by neuropeptide dysregulation, hypoxia, hyperglycemia, and infection (19). Individuals with diabetes may experience a range of complications. The specific diabetes complication that has the most significant influence on the severity of diabetic foot ulcers (DFU) remains uncertain. However, a study conducted by Mauricio

D. *et al.* indicated that microvascular issues have a stronger impact on the severity of DFU compared to other complications (20). Furthermore, Ghobadi *et al.*'s study (21) revealed a higher prevalence of cardiovascular issues among patients with diabetic foot ulcers (DFU). Based on Brennan *et al.*'s research, the severity of ulcers is a more accurate indicator of future mortality compared to other issues (22).

### **Distribution of DFU based on Wagner's categorization**

The distribution of DFUs according to Wagner's categorization shows a higher prevalence of Grade 2 ulcers compared to other grades. This suggests that living in rural areas may contribute to inadequate foot care practices and walking without shoes. These discrepancies can be attributed to economic and educational gaps across the research populations. They can be viewed as a result of early medical advice-seeking behavior, early diagnosis, and early treatment, which help avert further repercussions.

### **5. Conclusion**

The findings of the present study indicate a substantial prevalence of diabetic foot ulcers in Babylon. Individuals with diabetes complications had a higher frequency of DFUs was higher in individuals with complications connected to diabetes compared to those without comorbidities. An analysis of these variations is conducted by considering the economic and educational inequalities among the groups being studied. Additionally, the absence of a protective sensation and inadequate routine foot care are significant risk factors for diabetic foot ulcers (DFUs). Treating diabetic foot ulcers necessitates specific treatments and substantial endeavors to prevent their occurrence, promote early identification, efficiently manage diabetes, and modify related risk factors. Therefore, additional investigation is necessary to establish the

correlation between these risk factors, highlighting the importance of promptly implementing preventative actions.

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#### **Conflicts of Interest:**

“The authors declare no conflicts of interest.”

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