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# Prevalence of Diabetic Foot Ulcers among People with Diabetes Mellitus

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## Abstract

**Introduction:** With 8.6% prevalence, India tops the list in terms of the burden of diabetes. A major complication of diabetes mellitus is diabetic foot ulcer, which affects type 2 diabetes more frequently. This study's objective was to determine the prevalence and risk variables that contribute to the development of diabetic foot ulcers.
**Method:** A hospital-based cross-sectional survey was conducted with 108 type 2 diabetic patients who were chosen from the outpatient department of a major diabetic care facility. The socio-demographic data was gathered. The clinical biochemistry lab attached to the hospital performed the measurements of biochemical variables. The Wagner Meggitt Classification was used to stage each patient's diabetic foot.
**Results:** Prevalence of Diabetic Foot Ulcer was 10.2%. Grade III was the most prevalent stage of presentation, followed by Grade IV according to classification system by Wagner Meggitt. No significant correlation between the DFU group and other metabolic parameters such hypertension, retinopathy, neuropathy, HbA1c, cholesterol, HDL, and LDL were discovered.
**Conclusions:** There were 10.2% of diabetic individuals presented with foot ulcers. Diabetes related foot ulcers were more common in males with an average age of 56.08± 0.69 years.

## Keywords

Diabetic foot ulcer, Type 2 diabetes mellitus, Wagner-Meggitt Classification, Diabetic Peripheral Neuropathy.

## Introduction

Diabetes Mellitus is a global epidemic (IDF Diabetes Atlas Group, 2015). With a regional prevalence of 8.8%, 88 million individuals in South East Asia suffer from diabetes , 77 million of whom reside in India (IDF Atlas, 2019). Diabetes prevalence among Indians ranges from 12–17% in urban areas to 2.4% in rural areas (Bengalorkar & Nagendra, 2011). A full-thickness wound that is found at a level distal to the ankle in diabetic individuals is commonly known as a diabetic foot ulcer (Apelqvist et al., 2000; Reiber & Ledoux, 2003). According to estimates, 6.3% of people worldwide have diabetic foot ulcers. Type 2 diabetics and males are more likely to get these ulcers than females (Zhang et al., 2017). In the upcoming ten years, it's anticipated that the prevalence of diabetic foot disease would increase even more (Amin & Doupis, 2016; Boulton et al., 2005). The frequency and incidence of foot issues in India are not well understood. This study's objective was to gather information on the prevalence and risk factors for developing foot ulcers particularly those connected to diabetes.

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## Methodology

The outpatient surgery department of Lourde Hospital in Thaliparamba, Kerala, was the site of the hospital-based cross-sectional study. Based on the criteria for inclusion and exclusion, subjects were chosen. The study included all cases of Type 2 diabetes mellitus and that were older than 18 and had lived in the study area for at least a year. Patients with Hansen's disease, gestational diabetes mellitus, stroke, bilateral below knee amputations, and foot deformities caused by other conditions were also disqualified. Data was collected during the period of March 15 to March 25, 2023. Consecutive samples of 108 patients were chosen (Ramalingam et al., 2023).

### Ethical Considerations and Permissions

All subjects voluntarily provided their informed consent. Before the investigation began, the institutional ethics committee's approval was obtained.

### Outcome measures

Diabetic Foot Ulcer was the outcome measure for the study. Presence of Diabetic Foot Ulcer was taken from clinical records. Each patient's diabetic foot was staged using the Wagner Meggitt Classification of Diabetic Foot Ulcers (Shah et al., 2022). The primary investigator used the questionnaire approach to obtain the demographic data.

### Statistical Analysis

SPSS (Statistical Package for Social Sciences) V.15.0 (SPSS South Asia, Bangalore) for Windows was used to tabulate and analyse the gathered data. The proportions of the findings and their 95% confidence intervals were provided. The link was discovered using the chi-square test, and a p-value of 0.05 or lower was deemed significant. In order to identify the risk factors, multiple logistic regressions were performed.

## Results

### Participants' socio-demographic traits

One hundred eight people in all participated in the study. Women made up more than half of the respondents (68), while men made up the remaining (40). Age 56 to 65 makes up the majority of their demographic. Nearly 41.66 percent of the study's participants had diabetes for 16 to 20 years. There was systemic hypertension in 69.44%. The majority of respondents (68.51%) had a family history of diabetes and were literate (65.74%). The most frequent consequences were reported to be neuropathy (71.29%), followed by retinopathy (21.29%) (Table 1).

Table 1. Socio-demographic variables of participants with Type 2 DM (n=108)

| Variables | | Frequency (%) |
|---|---|---|
| Gender | Male | 40 (37.03) |
| | Female | 68 (62.96) |
| Age (years) | 18-25 | 2 (1.85) |
| | 26-35 | 5 (4.62) |
| | 36-45 | 9 (8.33) |
| | 46-55 | 19 (17.59) |
| | 56-65 | 37(34.25) |
| | 66-75 | 29 (26.85) |
| | 76-85 | 7 (6.48) |

| | | |
|---|---|---|
| Duration of diabetes (years) | <5 | 2 (1.85) |
| | 5-10 | 6 (5.55) |
| | 11-15 | 25 (23.15) |
| | 16-20 | 45 (41.66) |
| | >20 | 30 (27.77) |
| BMI (kg/m$^2$) | Underweight | 13 (12.03) |
| | Normal | 37 (34.25) |
| | Overweight | 58 (53.70) |
| HbA1c (g %) (Mean±SD) | | 8.08±0.88 |
| Family history | Yes | 74 (68.51) |
| | No | 34 (31.48) |
| Education | Literate | 71 (65.74) |
| | Illiterate | 37 (34.25) |
| Hypertension | Yes | 75 (69.44) |
| | No | 33 (30.55) |
| Neuropathy | Yes | 77 (71.29) |
| | No | 31 (28.70) |
| Retinopathy | Yes | 23 (21.29) |
| | No | 85 (78.70) |

Table 2. Participants reported with diabetic foot ulcer

| Variables | | With DFU (n=11) Frequency (%) | Without DFU (n=97) Frequency (%) | p value |
|---|---|---|---|---|
| Gender | Male | 6 (54.54) | 34 (35.05) | 0.581 |
| | Female | 5 (45.45) | 63 (64.94) | |
| Age (Mean±SD) | | 56.08±0.69 | 58.09±0.70 | 0.383 |
| BMI (Mean±SD) | | 24.09±1.65 | 25.01±0.79 | 0.960 |
| HbA1c (g %) (Mean±SD) | | 8.01±0.59 | 8.15±0.21 | 0.089 |
| Hypertension | Yes | 8 (72.72) | 67 (69.07) | 0.704 |
| | No | 3 (27.27) | 30 (30.92) | |
| Cholesterol (mg/dl) (Mean±SD) | | 216.30±15.10 | 214.96±26.59 | 0.403 |
| Triglycerides (mg/dl) (Mean±SD) | | 159.09±17.06 | 157.63±23.07 | 0.710 |
| Low Density Lipoprotein (mg/dl) (Mean±SD) | | 121.53±10.75 | 114.80±21.71 | 0.153 |
| High Density Lipoprotein (mg/dl) (Mean±SD) | | 60.05±11.01 | 58.29±9.54 | 0.603 |
| Neuropathy | Yes | 7 (63.63) | 70 (72.16) | 0.098 |
| | No | 4 (36.36) | 27 (27.83) | |
| Retinopathy | Yes | 2 (18.18) | 21 (21.64) | 0.259 |
| | No | 9 (81.81) | 76 (78.35) | |
| Family History of DM | Yes | 6 (54.54) | 68 (70.10) | 0.578 |
| | No | 5 (45.45) | 29 (29.89) | |

P≤0.05(significant), P≤0.01(highly significant)

The frequency of foot ulcers according to participant characteristics is shown in Table 2. Males made up more than half (54.54%) of the participants with DFU. Patients with DFU had an average age of 56.08± 0.69 and a mean BMI of 24.09± 1.65. According to the results, the mean values for HbA1c (g%), cholesterol (mg/dl), triglycerides (mg/dl), low density

lipoprotein (mg/dl), and high-density lipoprotein (mg/dl) were 8.01±0.59, 216.30±15.10, 159.09±17.06, 121.53±10.75, and 60.05±11.01, respectively. Only 18.18% of them had retinopathy; instead, more than half of them had neuropathy (63.63%), hypertension (72.72%), and other conditions. When employing Z testing, no significant correlation between the DFU group and other metabolic parameters such hypertension, retinopathy, neuropathy, HbA1c, cholesterol, HDL, and LDL were discovered (Table 2).

Table 3. Diabetic foot ulcer (DFU) classification system by Wagner Meggitt

| Stages of presentation | Frequency | Percentage % |
|---|---|---|
| Grade 0 | 0 | 0 |
| Grade 1 | 0 | 0 |
| Grade II | 1 | 9.09 |
| Grade III | 5 | 45.45 |
| Grade IV | 3 | 27.27 |
| Grade V | 2 | 18.18 |
| Total | 11 | 100 |

The Wagner-Meggitt classification of diabetic foot was used in this investigation. Grade III (45.45%) was the most prevalent stage of presentation, followed by Grade IV (27.27%), Grade V (18.18%), and Grade II (9.09%). (Table 3).

Table 4. Prevalence of diabetic foot ulcer based on area of infection

| Area of infection | Frequency | Percentage |
|---|---|---|
| Plantar foot ulcer | 6 | 5.56 |
| Dorsal foot ulcer | 3 | 2.78 |
| Both plantar and dorsal | 2 | 1.85 |
| Total | 11 | 10.2 |

Eleven individuals in the study were presented with Diabetic Foot ulcer. The prevalence of foot ulcer in diabetic patient was 10.2%. Ulceration affects the plantar aspect of the metatarsal heads, the heel (5.56%), and the dorsal region of the toes (2.78%) in individuals with DFU (10.2%) (Table 4).

## Discussion

Globally, diabetes mellitus exhibits epidemic-like characteristics. Even though there have been numerous research on DFU in other nations, Kerala's population has not had its pattern of complications thoroughly examined. This study's goal was to investigate the prevalence of diabetic foot ulcers and the risk factors connected to them among diabetic patients in Kannur, Kerala. In our study, the prevalence of Diabetic Foot Ulcer was 10.2%. The prevalence of foot ulcers among diabetic people worldwide ranges from 3% to 13%, according to a comprehensive review published in 2016 (Zhang et al., 2017). In India, 4.54% of individuals with type 2 diabetes mellitus were found to have diabetic foot ulcers (Das et al., 2020). The male sex has been suggested as a risk factor for the development of diabetic foot lesions in past researches (Gadepalli et al., 2006; Raja, 2007), and the present study found that the male population was more prevalent than the female population. The average age of DFU patients

was 56.08 years, which is consistent with previous research (Al-Maskari & El-Sadig,2007; Abbott et al., 2002; Al-Rubeaan et al., 2015). Only 2 (18.18%) out of the 11 individuals experienced diabetic retinopathy alterations, which is less than the previous results ( Shibu et al., 2017) in Kerala. At enrolment, the majority of these patients had poor glycaemic control, with a mean HbA1C of 8.01±0.59. These results corroborate those of (Shibu et al., 2017 and Goldin et al., 2006). One of the main risk factors for diabetes patients with foot complications was systemic hypertension (72.72%), which was similar to a prior finding (Jyothylekshmy et al., 2015) in Kerala.

The study was carried out in the hospital's OP department so that we could gather a large number of patients with various foot complications. Since the study was carried out in a secondary care facility, thus the number of patients there who had diabetic foot issues may not accurately reflect the situation.

Health care providers need to focus more on DM patients who have the established risk factors for DFU. It is advised that future research on the subject incorporate behavioural aspects such past alcohol intake history and primary data with prospective studies. If it had been a multicenter study that lasted longer, the information might have been of significantly more value.

## Conclusion

Prevalence of foot ulcer in people with diabetes is 10.2% in the present study. The study emphasises the need of proper foot hygiene, the necessity of early diabetes detection, and the necessity of ongoing monitoring of diabetic complications.

## Glossary of Abbreviations

DM- Diabetes Mellitus, SD- Standard Deviation, BMI- Body Mass Index, HbA1c- Glycated Haemoglobin, ANOVA- Analysis of variance, DFD- Diabetic foot syndrome or disease, DFU- Diabetic foot ulcer, WHO- World Health Organization

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