

Prevalence and Predisposing Factors of Diabetic Foot Ulcer Among Adult Patients With Diabetes Mellitus Presenting to Aldarga Diabetic Center, Wadmedani, Sudan 2020 - A Longitudinal Cross Section Study

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Research Article

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Abstract

Objectives: To assess the prevalence of diabetic foot ulcer (DFU) in Wad Medani, Gezira state, Sudan, and the duration of diabetes associated with it.

Methods: The study was comprehensively based on primary data obtained via a longitudinal cross-section random sample of 400 patients with diabetic mellitus presenting with Aldarga. The data collection tool was a structured questionnaire. Core questions were on main dimensions: Sociodemographic variables and duration, type of diabetes. Data were analyzed with SPSS program version 20, using descriptive and inferential statistics, namely, frequency tables and graphs, Fisher Chi-square, exact test of association, and logistic regression.

Results: The static profile of the participants indicated that genetic background is an important factor in contracting diabetic mellitus. The calculated prevalence rate was 16.6% (17.1% for males and 16.1% for females) with overall probability limits. The analyses of associations indicated that the number of variables in all three dimensions have significant association with the development of DFU. The logistic regression pinpointed two factors with significant odds to develop DFU, namely, the duration of diabetic last fasting blood glucose value and that the duration of the illness is notable.

Conclusion: The result suggests extensive awareness programs to control the negative effect of prolonged duration of diabetic's are necessary especially crucial aspect of monitoring the blood sugar level under strict medical supervision.

Introduction

Globally about 463 million people are living with diabetes, among them, three-fourth (76.2%) are living in the middle, and a few (3.13%) are living in low-income countries. The International Diabetes Federation has anticipated the number of diabetes patients to raise to 700 million by 2045. Surprisingly, almost half of type-2 diabetes (DM2) adult patients are unaware that they are suffering from this disease. Moreover, 185.8 million undiagnosed diabetes are from middle-income countries [1]. Most of the time DM2 remains completely asymptomatic for a long duration and by the time patient diagnosis they develop complications like neuropathy, retinopathy, metabolic disorders, diabetic foot ulcers (DFUs) which are later difficult to treat. Diabetic foot ulcer is defined as the presence of an ulcer in the lower limb which is associated with neuropathy and/or peripheral arterial disease in a patient with diabetes [2]. Globally, every 30 s, a lower limb is lost, which is a major sequela of diabetes. The incidence rate of DFU in diabetes patients is 2% (9.26 million) and this risk increases 17–60% with a history of DFU in the next three years [3]. Prevalence of diabetes in many Middle East countries has made this region one of the global diabetes hot spots. Due to rapid socioeconomic growth, lifestyle changes, and increasing obesity prevalence, the number of people with diabetes is expected to double by 2045 in this region [4]. Diabetes mellitus (DM) is a major health problem in Africa and worldwide. The prevalence of diabetes is expected to increase at an alarming rates in Africa. It's estimated that around 20 million Africans are now living

with diabetes, comprising a challenge for health systems at present and in the future, Fifty-five full-text papers and ten abstracts were retrieved, reporting data from 19 African countries on 56,173 diabetic patients. According to the data collected, the overall prevalence of foot ulcers was 13% and increased over time, especially since 2001. Approximately 15% of patients with foot lesions underwent major amputation and 14.2% died during hospitalization. In patients with diabetic ulcers, insulin therapy was uncommon and neuropathy was the most common predisposing factor, but the prevalence of peripheral arterial disease correlated with amputation rates. Amputation and mortality decreased over time, probably as result of the implementation of screening programs in the last ten years. Mortality was directly related to previous amputation. Interpretation: Diabetic foot disease in Africa is a growing problem and is burdened by a high rates of in-hospital mortality. Educational interventions and screening programs including evaluation of vascular status may play a crucial role to counter diabetic foot disease in Africa [5]. There is a high prevalence of DM and glucose intolerance in the urban population of RNS. The River Nile State (RNS), north Sudan [6], Albobarak et al. showed that prevalence of diabetic foot ulcer was 18.1% and the risk of development of diabetic foot ulcer is increased with duration of diabetes more than 10 years [7]. Diabetic foot ulcer is among the commonest complications of diabetic mellitus attributed to a number of morbidity and mortality cases in diabetic patients. Nowadays, the incidence of diabetic foot ulcer is increasing due to the increased prevalence of diabetes. However, the risk factors of the problem are less or not studied in Gezira State, Sudan. Hence, this study was conducted to assess the determinants of diabetic foot ulcer and type, duration of diabetics among adult patients with diabetes attending a diabetic clinic in Aldarga Diabetic Center, Wadmedani, Sudan 2020.

Material And Method

An institutional longitudinal, cross-sectional design was used to conduct the study among patients presenting at Aldarga Diabetic Health Center in Wadmedani Town, Gezira State, Sudan, between the period September 2020 to December 2020. The center is located in the North of Wadmedani town, 186 KM south of Khartoum, the capital of Sudan. The center was established in 2007 and was opened as a specialized diabetic center, a reference for the Central Region of the country, with an area of 600 square meters. It consists of two departments, one for diabetic foot surgery and the second for diabetic internal medicine of internal diabetes. It consists of 4 doctors' offices; each contains three doctors, two general doctors, and one family doctor. It also includes a general laboratory, a dental clinic, and statistical and computer labs. There is a special office for therapeutic nutrition for diabetics, health nutritional education for diabetics, and a section on immunization.

The study includes all diabetes mellitus patients who attended the diabetic follow-up clinic at Aldarga Diabetic Center in Wadmedani town. During the study period, all patients were targeted irrespective whether these patients had DFU or not because the prevalence methodology attempts to estimate the proportion of reported patients who develop DFU.

◆ **Data collection:** A structured data collection tool was developed after carrying out a literature review mainly adapted from the publications of WHO and UNICEF. Core questions were adapted from previous

studies with four main dimensions: **Sociodemographic variables**: age, sex, family type, marital status, educational status, residence, and average monthly income; **foot self-care attention variables**: foot wear, fear of ulcers, foot cleaning, and foot washing; occasional foot inspection, **Clinical variables** were taken from the patients themselves, type of diabetes treatment ,duration of diabetes.

Operational Definitions:

Diabetic foot: The International Working Group on the Diabetic Foot (IWGDF) has defined the diabetic foot as infection, ulceration, or destruction of tissues of the foot of a person with currently or previously diagnosed diabetes mellitus, usually accompanied by neuropathy and/or peripheral arterial disease (PAD) to the lower extremity [8] **Diabetic foot ulcer**: these are nondramatic lesions of the skin on the foot distal to malleoli of a person who has diabetes mellitus.

Diagnostic criteria for diabetes mellitus or Measurement of Diabetes Mellitus:

Random plasma glucose values of ≥ 200 mg/dL (≥ 11.1 mmol/L) or 1(2) fasting plasma glucose values of ≥ 126 mg/dL (≥ 7.0 mmol/L) or (3) 2-h. Oral glucose tolerance test (GTT) value in venous plasma ≥ 200 mg/dL (≥ 11.1 mmol/L) (4) glycated hemoglobin (HbA_{1c}) $\geq 6.5\%$ (≥ 48 mmol/molHb)[9].

◆ Sample size and sampling design

A random sampling method was used to select the sample in which population (Total diabetic patients in 2020 reported to the diabetic follow-up clinic.) The simple random sampling equation for the provisional sample size n^* was calculated using the following formula:

$$n = (t^2 \times p \times q) / (d^2)$$

Where:-

n^* : Required sampling size.

P: Anticipated population proportion was taken as 50% because it gives the maximum possible sample size. If we take the estimated prevalence rate for Sudan of 0.15 as P, the sample size will be 195, but we prefer a larger sample.

t: Confidence level taken as 95%.

d: Absolute precision required on either side of the anticipated proportion taken as 5 %

Then the provisional sample was multiplied by a design effect of 2 to give the final sample n :-

$$n = (2^2 \times 50 \times 50) / (25) = 400$$

400 participants were successfully campassed by the field data collection team, which consisted of the principal researcher and the field data collectors. The field data collectors were all paramedical working in the center and trained for 10 days on data collection methods and the interview/observation methodology. The training sessions focused mainly on training the interviewers on measurement scales of hypertension, random blood sugar, height, length, and lipid. Twenty-one data collectors were trained. Quality of the collected data was checked by three well-trained paramedical staff who entered the data in SPSS program. Total Diabetic patients who reported to the center in 2020 were 40507 classified by months, with an average of 3376 diabetic patients per month.

The procedure used for selecting sampling units is twofold. First, we calculate the systematic sampling interval factor by dividing the number of diabetic patients during the data collection period (November-December 2020) by the sample size i.e. $N/n = 1823/400 = 4.55 \cong 5$. The sample unit number 5 was selected first. The rest of the sampling units were selected according Kish selection procedure to cater for gender (Kish, L., 2004).

The data collection instrument was a structured questionnaire written in English and then translated into Arabic. The structured data collection tool was developed after carrying out a literature review and was mainly adapted from the publications of WHO and UNICEF. The structured data collection tool was pretested. The pretest was carried out in 8% (60 households) of the total sample size of the study and the internal consistency measured under reliability by calculating Cronbach's alpha coefficient. (The value of Cronbach's Alpha coefficient was greater than 90%).

◆ Data Analysis methods

Descriptive statistics was initially undertaken to analyze the composition of the sample. Data were coded and entered into a computer using two of the latest versions of the prepared packages of statistical analysis, namely, Statistical Package for Social Sciences (SPSS) version 24.0/25.0 version for Windows. The program were used in different stages of data processing to process the raw data obtained from the questionnaires. Quantitative analysis of the question responses obtained from the questionnaire were summarized, portrayed, and analyzed on a statistical basis to offer the researcher the opportunity to analyze the responses and identify whether the results are skewed [10].

The following statistical analyses were run:

- A pilot study was conducted to establish content validity.
- Face validity was established through the circulation of the questionnaire to 60 pilot respondents.
- In all analyses, the test was two-sided and a p value less than or equal 0.05 was considered

Statistically significant, while a p value less than or equal 0.01 was considered statistically

Highly significant.

Prevalence of Diabetic Foot Ulcer

Of the 400 participants, 96 participants were clearly diagnosed as foot ulcer, giving a proportion of 33% in the sample. However, this proportion has to be adjusted by the total population of diabetic patients reported to the center, recorded as 40,127 in 2020 using the following equation.

$$Prevalence = \frac{P}{1 + \frac{P}{K}} * \sqrt{(N - n)I(N - 1)}$$

Where:

P = the proportion with diabetic foot ulcer in the sample in 2020.

K = Total Patients with diabetic foot ulcer recorded in Aldarga center in 2020. (17,350)

N = Total patients with diabetic mellitus recorded in Aldarga Center in 2020.

n = sample size.

The values of p and key were obtained from Aldarga Center statistical office. Substituting in the prevalence equation, the prevalence rate in this study is estimated as 16.6% with 5 percent probability limit of (14.0 -19.2).

The DFU segregated by gender using the same methodology gives the prevalence rate for females as 16.1%, which is a little less than that for males of 17.1%.

Results

(1) Respondent's socioeconomic characteristics

The survey data were initially analyzed using frequency tables and descriptive statistics. Of the 400 hundred sampled respondents, 55% were males and 44.5 were females living in predominantly extended (68%) families and the majority were living in towns (56.8%). Only 8.5% reported high income level, 33.5% reported low income, and the majority are of medium income level (58%).

Table (1) shows the frequency distribution and descriptive statistics of the participant's socioeconomic characteristics. The youngest patient in the sample was 30 years of age and the oldest was the oldest was 89 years. The age distribution classified in the 5 years age group shows an expected pattern with sharp skewness to the right, where the majority are over age 50 years (79%) and more than half are above 60 years of age. The mean age is 59.9 years with approximately similar median and mode, indicating that the distribution is mesokurtic showing confidence interval 59.9 ± 1.31 .

The majority of respondents are married (69.3%), 6.8 % are single with an abnormally untypical high proportion of widows and divorcees (24%). The majority is either not educated or had basic education (67.6), 20.3% have secondary education and 12.3% in the category university and over and these tally

very well with occupational classification as 65.8% either unemployed (38%), housewives (13.5%) or having unspecified jobs (14.3%). The general picture that can be drawn from the respondent's socioeconomic status is that diabetic patients reporting to Aldarga center are of low social class category

(2)- Factors relating to clinical issues

Among the 96 participants were clearly diagnosed as foot ulcer, giving a proportion of 33% in the sample. Respondents 47.3% had Type II diabetic mellitus and 4.8 % had Type I. The majority of diabetic patients have disease duration between 5 and 10 years, 24.5% are living with the disease for more than 10 years and 17.3% have it for less than 5 years. 10.3 % of the participants have the disease in their families and 48.3% have the disease in the first or second (kinship) with a duration between 1 to 5 years.

(3)- Factors relating to measurement of diabetic mellitus based on the last fasting plasma glucose level

The measurement of diabetic mellitus based on the last fasting plasma glucose level is shown in Fig. 1. The majority of respondents (50.7%) were having a level between 126–275 mg/dL, classified as poorly controlled diabetic. Respondents classified as controlled (fasting plasma glucose value of ≥ 126 mg/dL (≥ 7.0 mmol/L) represent only 4.8%, 38% are classified as uncontrolled and 7.5% are classified as severely uncontrolled. The mean last fasting plasma glucose level is 250 mg/dL with standard error 4.35, thus giving probability limits of (242,259) and the probability is

5% found that a newly reported patient to center has fasting plasma glucose level will be out of this range up or down.

Logistic Regression

Logistic regression is used here to filter the highly significant associates of DFU by Odds Ratios for ranking purposes. The Fisher exact test showed that the highly significant associates are: diabetic in the family (kinship), a, duration of diabetic to diabetic,, last fasting plasma glucose ,. These are fitted as explanatory variables in a binary logistic model. Only two variables were selected by the model: duration of diabetic, last fasting plasma glucose. The Wald statistics for all independent variables confirmed the significant effect on DFU. Looking at the result of regression for the last fasting plasma glucose value, there is a highly significant overall effect (Wald = 5.806, df = 1, p = .016) "Sig at 5%.".. Based on our output, we can see that 2 factors are particularly highly significant. Putting them in order, we notice that the duration of diabetic has the highest odds ratio of 35.6 times more likely to cause DFU (p value = 0.000), the last fasting plasma glucose value comes second with (35.66) times more likely to cause DFU.

Discussion

This study as far as we know may be the first to estimate the prevalence of DFU in Gezira state- Sudan, although a number of studies on the subject have been done in Khartoum In a study to determine the DFU prevalence in Khartoum, the capital of Sudan Albobarak *Eta!*. Estimated the prevalence as 18.1% with a 95% confidence interval of (13.78–22.34) from a sample of 301 adults over 18 years with type II diabetes attending the diabetic center in Khartoum in 2017[11]. We notice that our own estimate of DFU prevalence (16.6), which is the first attempt in Gezira as stated above, lies within the probability limits of the estimate provided by this study. We also believe that our estimate is superior since it was adjusted by the population of all diabetic patients reported to the study unit during 2020. They also found that among all metabolic variants, duration of diabetic was the major risk factor in contracting DFU. In a study of ten amalgamated studies in Ethiopia covering 3029 patients with diabetes millets, DFU prevalence rate was 15.3% with.3.91 OR at 95% CI for duration of illness as a risk factor, just a little less than our estimate, but it lies in the same interval. [12]. in the Southwest regional hospitals of Cameroon. Cross- sectional study, of the 203 participants included, 63.1% were females. Age ranged from 26 to 96 years. The median duration of diabetes was 4.0 years (The prevalence of diabetic foot ulcer was 11.8%) [13].in our study the duration of diabetes in relation to diabetic foot ulcer is very significant p value was (0.000**) and DFU prevalence (16.6). The finding of this study showed that the type of diabetes, duration of diabetic was very significant, p value was [0.013, 0.000], this is consistent with the study conducted in diabetic foot ulcer in Nigeria A total of 336 patients (55.1% male) with a mean age of 55.9 ± 12.5 years were enrolled in this study. Majority (96.1%) had type 2 diabetes [14]. In this study, there was a significant correlation between the duration of diabetic and presence of diabetic foot ulcer **Chi-square(Fisher Exact Test), DF, P-value (88.19, 2, 0.000**)** respectively as research done by Zubair M, Malik A, Ahmad J showed that It has been examined that there is a positive correlation between ulcer duration and BMI, amputation rate and BMI [15]. and liked same results done by Hicks CW, Selvin E showed that The prevalence of peripheral neuropathy is estimated to be between 6 and 51% among adults with diabetes depending on age, duration of diabetes, glucose control [16]. Also another study had a strong association with duration of diabetes and DFU found that out of 196 patients 80.1% were male. One hundred and forty-six (74.48%) patients were in the range of 40–70) years. Right foot was more commonly involved (65.3%). 91.3% patients had diabetes of more than 5 years duration [17.]. So from all above literatures, reviews and results of our study give us as family doctors especially in Gezira State, Sudan, Tobe more attention to our diabetics patients especially type 2 to decrease the risk factors that can accelerate diabetic foot ulcer and put in our mind that newly discover diabetes after 5 to 10 years most probably will develop [DFU] from all these published paper so we negotiate all these complication with our patients to put them in picture, and hope that we can decrease prevalence of [DFU] in our Gezira locality.

Conclusion

All these three variants are controllable, if the blood sugar level were kept under control under close medical supervision and patients own health attention.

Recommendations:

σThe etiology of diabetic foot ulcers is multifactorial, so recommendations that management needs collaboration of multifactorial disciplines.

σDoctors especially family doctors, should have great responsibility to decrease (DFU) because he had catchment map and the area of their health center where he worked and known in and out of family history.

σ The researcher suggested that consultants of family doctors especially in Gezira state, Sudan, must play a major role in decreasing (DFU) because the family medicine concept established years ago in Gezira state and health care providers should spend more time educating and training diabetic patients on foot care.

Declarations

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Conflict of interest statement:

The authors declares that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethical Approval:

Before initiating the field survey, the objective of ethics in research was insured by obtaining ethical clearance from the Director of Health Affairs in Wad Medani locality of Gezira state. A supportive formal letter was written to Aldarga diabetic Center. Data collection was done after permissions were obtained from the center managers, and oral informed consent was obtained from the study participants to start data collection after insuring them that ethical aspects regarding the confidentiality, privacy, and consent of the data will be seriously considered during the research process.

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Tables

Table (1): frequency distribution and descriptive statistics of major respondent’s indicators

Variable	N	Percent	Central tendency	Standard error of the mean
Age				
30-34	15	3.8		
35-39	10	2.5		
40-44	31	7.8	Mean = 59.5	1.31
45-49	28	7.0	Median = 60	-
50-54	42	10.5	Mode = 58	-
55-59	61	15.3	Skewness = -.222	0.012
60-64	48	12.0		
65-69	57	14.3	Kurtosis = 0.555	0.243
70 and over	108	26.8		
Total	400	100		
Marital Status				
Single	27	6.8	Median=2.0	-
Married	277	69.3	Skewness= 0.976	0.122
Widow	72	18.0	Mode = 2.0	-
Divorced	24	6.0	Kurtosis= 0.132	0.233
Total	400	100		
Educational Level				
Illiterate	34	8.5		
Khalwa	77	19.3	Median=3.0	-
Basic	159	39.8	Skewness =0.057 0.163	
Secondary	81	20.3	Mode=3.0	-
University	42	10.5	Kurtosis =0.223 0.232	
Postgraduate	7	1.8		
Total	400	100		
Occupation				
Professional	4	1.0		
Business	60	15.0	Median=8.0	
Employee and uniform	38	9.6	Skewness =0.234 0.163	
Worker and farmer	35	8.8	Mode=9.0	-
Housewife	54	13.5	Kurtosis = 0.232	0.122

Unemployed and others	209	52.3		
Total	400	100.0		

Source: Researchers own survey, 2020

Table (2): Diabetic related disabilities

Factor	N	%
<i>Diabetic affected body Organ</i>		
<i>Leg</i>	19	4.8
<i>Feet</i>	77	19.3
<i>Teeth</i>	46	11.5
<i>Eyes</i>	187	46.8
<i>No Affected organ</i>	71	17.8
Total	400	100.0
<i>leg or foot disability</i>		
<i>Yes</i>	96	24.1
<i>No</i>	304	75.9
Total	400	100.0
<i>Type of disability</i>		
<i>Functional</i>	66	16.5
<i>Muscle</i>	63	15.8
<i>Wound</i>	96	24.1
<i>not applicable</i>	268	43.6
Total	400	100.0
<i>Duration of leg and foot disability</i>		
<i>1-12 month</i>	26	6.5
<i>1-5 years</i>	43	10.8
<i>5 years+</i>	27	6.8
<i>no applicable</i>	304	75.9
Total	400	100.0
<i>Foot finger amputation</i>		
<i>One finger</i>	15	3.8
<i>More than one finger</i>	22	5.5
<i>No amputation</i>	363	90.7
Total	400	100.0
<i>Leg amputation cite</i>		

<i>Below the knees</i>	19	4.3
<i>above the knees</i>	9	4.8
<i>Not applicable</i>	372	91.0
Total	400	100.0
Foot amputation		
<i>Yes</i>	51	12.8
<i>No</i>	349	87.2
Total	400	100.0
Foot amputation cite		
<i>Below the uncle</i>	33	8.3
<i>above the uncle</i>	18	4.8
<i>Not applicable</i>	349	87.0
Total	400	100.0
Reason for tumor		
<i>Crash with solid body</i>	13	4.3
<i>Spontaneously</i>	38	8.7
<i>Not applicable</i>	349	16.8
Total	400	100.0

Source SPSS output based on: own survey , 2020

Table (3) Factors associated with DFU

Variable (N = 400)	Chi-square (Fisher Exact Test)	DF	P- value
Association of DFU with socioeconomic variables			
Age	53.3	54	0.500
Sex	1.68	1	0.195
Residence	0.00	1	1.000
Family type	0.22	1	0.632
Monthly income level	0.45	3	0.930
Marital status	0.43	1	0.514
Educational level	7.49	1	0.186
Income	0.62	2	0.736
Occupation	45.78	8	0.051- (0.043)*
Diabetic in the family (kinship)	112.96	2	0.004**
Association of DFU with Behavioral variables			
Practicing of sport	15.69	1	0.017*
Followed correct nutritional diet	0.002	1	0.978
Diabetic monitoring with Doctor	15.26	1	0.000**
Regular wound cleaning and dressing	17.57	1	0.001**
Smoking	4.08	2	0.343
Drinking Alcohol	0.26	1	0.608 ^a
Association of DFU with Clinical variables			
Type of diabetic	6.154	1	0.013*
Duration of diabetic	88.19	2	0.000**
Wearing diabetic shoes	6.23	1	0.043*
Last fasting plasma glucose value	177.83	119	0.000**
Lipid level	111.39	73	0.003**
Body Max Index	331.22	248	0.000**

Chronic diseases	1.39	1	0..238
Status of blood pressure ^b	1.652	2	0.438

Source SPSS output based on: own survey , 2020

*The probability in brackets is the asymptotic likelihood ratio test at 5% level of significance. it was calculated because the fisher exact test is marginally out of range.

** Significant at 1% level of significant

a: only ten participants in the sample drink Alcohol.

b: All BP variants were not significant in the first trial of fitting fisher exact test and for this reason they were not included in the table.

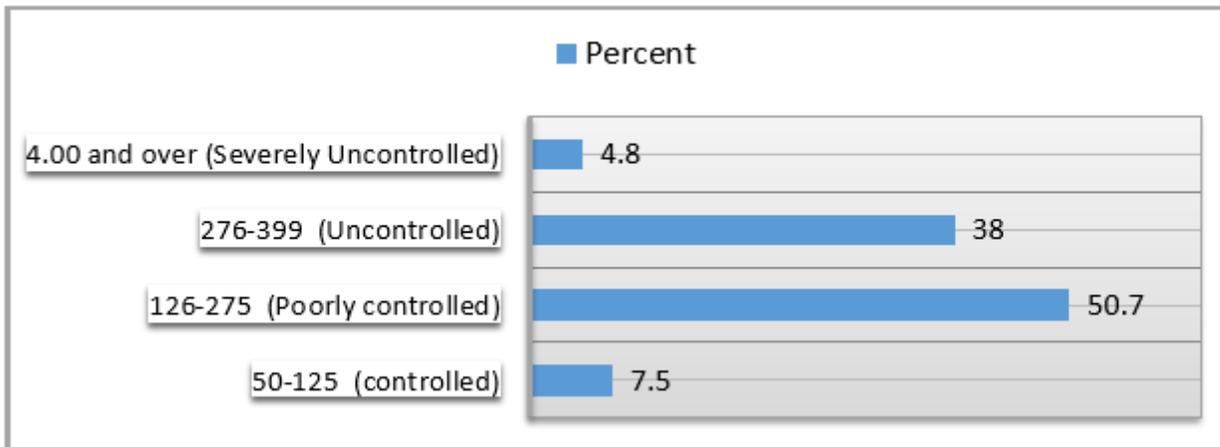
Table (4) Logistic Regression

Variables	B	S.E.	Wald	Df	Sig.	Exp(B) odd ratio	5% C.I.for EXP(B)	
							Lower Upper	Upper
Last fasting plasma glucose value	1.971	.818	5.806	1	0.016	35.656	34.053	37.259
Diabetic monitoring with doctor	8.06	0.468	2.973	1	.0085	1.117	0.200	2.034
Lipid level	.676	0.668	1.024	2	0.311	7.277	5.968	8.586
Duration of diabetic	2.692	1.149	5.494	1	0.00	40.306	38.054	42.558
regular wound cleaning and dressing	-0.500	0.582	.739	1	0.390	5.156	4.015	6.297
BMI	1.742	0..271	41.320	1	0.032	19.243	18.342	19.774
Kinship	.140	0.017	65.055	1	0.0431	.899	0.866	0.932
Constant	4.55	3.349	1.849	1	0.174			

Source SPSS output based on: own survey , 2020

(Wald = 5.806, df=1 p=.016) "Sig at 5%."

Figures



Descriptive Statistics

Last fasting blood glucose level	
N	400
Mean	250.38
Std. Error of Mean	4.330
Median	234.50
Mode	320
Std. Deviation	86.606
Minimum	50
Maximum	500

Figure 1

Last Fasting Blood Glucose level Source: Researchers own survey, 2020

Diabetic foot ulcer relationship in to duration of diabetic disease

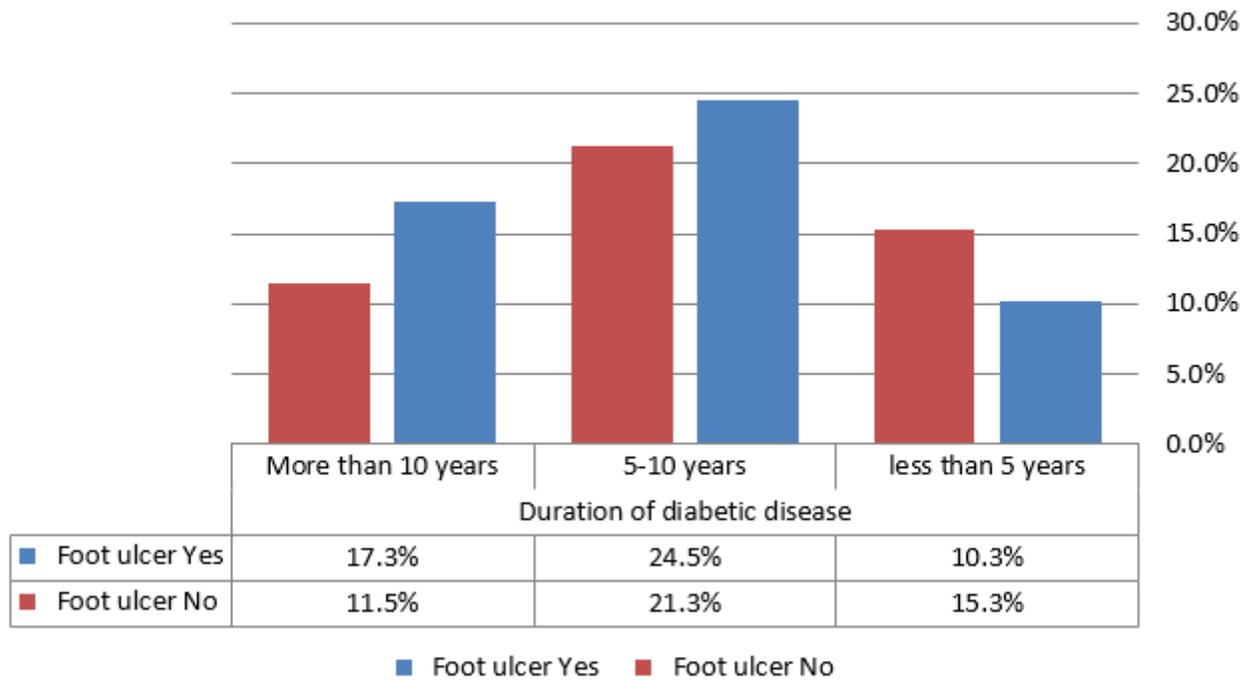


Figure 2

Diabetic foot ulcer in relation to duration of diabetic disease Source: Researchers own survey, 2020

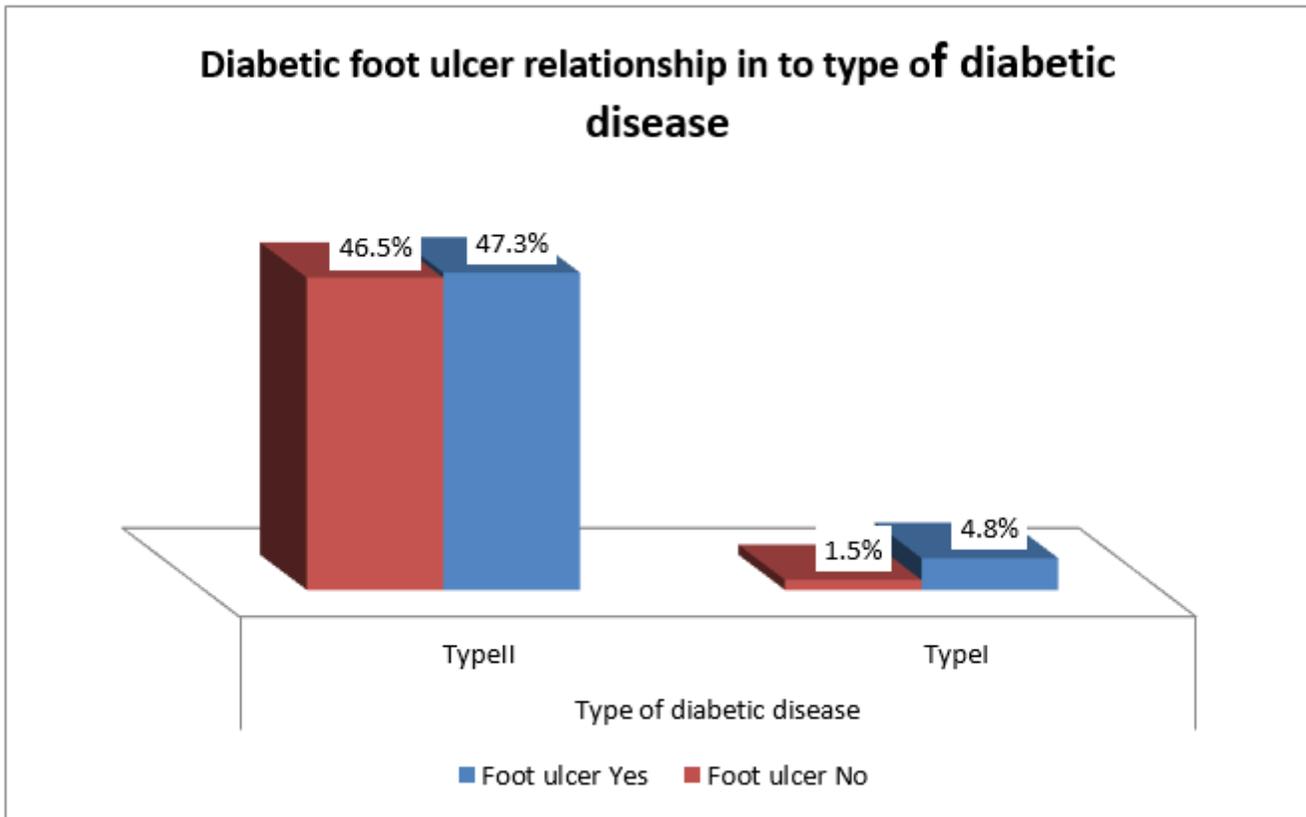


Figure 3

Diabetic Foot Ulcer in relation to the type of diabetic disease Source: Researcher from Alderaga health center, Gezira state, Sudan, 2020

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [figurs.docx](#)
- [Abeeroutput4.docx](#)
- [file.docx](#)