

Prevalence and Determinants of Erectile Dysfunction in Adult Diabetic Patients in the Southwest Region of Cameroon

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Abstract

Background: Erectile dysfunction (ED) is a common, bothersome and relatively under diagnosed complication of diabetes mellitus. This study was aimed to determine the prevalence of erectile dysfunction and its determinants. **Methods:** A cross-sectional hospital-based study was carried out in the Diabetology Units of the Buea and Limbe Regional Hospitals involving 332 male patients with diabetes and aged over 21 years. Data was analyzed using Stata and R version 3.5.3. **Results:** The mean age of the participants was 55years. Most participants (64.46%) were married. About half (50.60%) of the participants actively consumed alcohol, 11.45% were smokers and 57.83% were sedentary. 18 participants (5.42%) recorded high risk sexual behaviour. 54.32% of participants had a comorbidity and 43.90% were overweight. The prevalence of diabetic ED was 78.92%. Age, Fasting Blood Sugar and Glycated hemoglobin were found to be positive determinants of diabetic ED (odds ratio (OR) = 0.77, 95% CI -0.1 - 0.07). **Conclusion:** The prevalence of diabetic ED in this hospital population study is high, and both physician and patient-initiated measures are needed to reduce this prevalence and improve awareness, recognition and care of this condition.

Keywords

Erectile Dysfunction, Diabetes Mellitus, Prevalence, Determinants

1. Introduction

Erectile dysfunction (ED), also called impotence, is the inability to initiate and/or maintain an erection sufficient enough to perform satisfactory sexual intercourse [1]. It is a common medical problem that affects approximately 15% of men each year [2]. Diabetes mellitus (DM) is one of the leading causes of ED in men of all ages. It increases the risk to develop ED by fourfold, and diabetic patients experience the onset of ED 10 - 15 years earlier than their non-diabetic counterparts [3]. Sexual (including erectile) dysfunction is one of the leading causes of the poor quality of life experienced by diabetic patients [4]. This is expected, given ED (as well as other problems of sexual function) have a profoundly negative effect on the mental, reproductive and psychological health of an individual, as well as his social relationships.

The global prevalence of ED among diabetic patients ranges between 35% - 90%. Higher prevalence is recorded in some African countries, with the prevalence in Nigeria being 72% [5], Ethiopia 69.9% [6], South Africa [7] and Tanzania 55.1% [8]. Over half the identified cases in some of these countries had severe forms of ED [6]-[8]. This high prevalence translates to a high number of diabetic patients living a compromised quality of life.

Despite this burden, ED is still relatively under diagnosed among diabetic patients [9]. Due to the sensitive nature of ED, some patients may feel reluctant or uncomfortable to disclose it to their doctors, especially if they must initiate the discussion. Studies however reveal that these patients would love for their healthcare provider to initiate the conversation about ED [7]. Unfortunately, this is not the case, as many doctors do not routinely inquire about erectile dysfunction while consulting diabetic patients [10].

Studies differ in terms of identified determinants of ED among diabetic patients. Ahmed A *et al.* in Egypt [2] and Sharifi F *et al.* in Iran [11] did not show any positive association between smoking and ED in diabetic patients. Meanwhile, Zheng *et al.* in China revealed that smoking seemed to have a higher association with ED, but did not reach a statistically significant difference [12]. Sharifi F *et al.* in their yearlong study in Iran identified only age and Calcium Channel blockers as independent predictors for ED in diabetic patients [11]. Factors like glycated haemoglobin (HbA1c) and Body Mass Index (BMI), which other studies [13] identified were not the case in their study. With the wide range of possible determinants, and variable associations, there is a need for studies to be done in our own setting to establish what is relevant here.

This study is aimed to determine the prevalence, and identify the behavioral, medical and biological determinants of ED among a Cameroonian diabetic population.

2. Methods

2.1. Study Design and Setting

This was a cross-sectional hospital-based study conducted at the diabetology units of the Buea and Limbe Regional Hospitals Southwest Region of Cameroon.

2.2. Study Population

The study population included adult diabetic male patient (>20 years) attending diabetic clinic at the Buea and Limbe Regional Hospital.

We excluded from the study

- Presence of known genetic, traumatic or psychological causes of erectile dysfunction.
- Those who do not give consent.
- Mentally impaired or severely ill patients.

2.3. Sample Size and Sampling Method

Sample size was calculated using.

$$n = \frac{Z^2 p(1-p)}{d^2}$$

where:

n = minimum sample size, z = the standard normal variant at a confidence interval of 95% (standard value of 1.96), p = prevalence of ED among diabetic patients 41.5% [6], d = the margin of error (0.05).

$$n = \frac{(1.96)^2 (0.41)(0.59)}{(0.05)^2}$$

Therefore $n = 335$ which was the minimum sample size and were selected using a convenient sampling method.

2.4. Recruitment of Participants

Potential study participants were approached consecutively in the diabetology and in-patient units. The study's purpose, procedure, risks and benefits were explained to each one in a language they best understood. An information notice about the study was given to the potential participant. They were allowed to ask any questions they had, after which they signed a consent form to participate in the study.

2.5. Data Collection and Procedures

During recruitment, the principal investigator (PI) filled in a standardized structured questionnaire for each patient included in the study following an interview. Measures included socio-demographic data and medical history regarding duration of diabetes, type of diabetes, medications taken for diabetes; presence of co morbid conditions was obtained. Moreover, anthropometric measurements were recorded and blood for laboratory tests was taken.

HbA1c was analyzed using a portable HbA1c analysis, with the appropriate corresponding test strips, height was measured using a stadiometer and weight using an electronic scale from which the BMI was calculated using the formula Weight (in kilograms) divided by the square of the height (in meters). Obesity was defined as a BMI greater than or equal to 30. Blood pressure of the participants was measured using an automated blood pressure machine. Hypertension was defined as

SBP \geq 140 mmHg and/or DBP \geq 90 mmHg.

2.6. Data Management and Analysis

Data obtained was analyzed using Stata and R version 3.5.3. The IIEF questionnaire has 15 questions, and the total score is obtained by the sum of the individual scores of each question. It addresses and quantifies five domains: erection function, orgasmic (ejaculation) function, sexual desire (libido), intercourse satisfaction (ability to sustain intercourse), and overall satisfaction/premature ejaculation domains. It classifies individual sexual function domains into mild, moderate or severe form depending on scores. Prevalence was calculated by dividing the number of patients found to have ED (IIEF score \leq 21) by the total number of patients sampled.

Multivariate Logistic regression was used to identify and quantify the adjusted odds predictors of ED. These predictors were adjusted for age, education, gender, and some other demographic variables as well as medical data. A 2-tailed p-value of 0.05 was taken as statistically significant.

3. Results

3.1. Socio-Demographic Characteristics

The ages of the 332 participants ranged between 21 and 76 years, with a mean age of 55 years. Most participants (64.46%) were married and 75.30% of them were Christians. One third were retired (30.12%) while close to half (42.77%) of the participants earned over 100,000 CFA francs a month (**Table 1**).

Table 1. Sociodemographic characteristics of participants.

Characteristics	Category	Frequency (n)	Percentage (%)
Marital status	Married	214	64.46
	Single	44	13.25
	Divorced	38	11.45
	Widowed	36	10.84
Religion	Christianity	250	75.3
	African traditional religion	24	7.23
	Islam	18	5.42
	Others	40	12.05
Level of education	Tertiary	116	37.35
	Secondary	124	34.94
	Primary	86	25.9
	No formal education	6	1.81
Occupation	Retired	100	30.12
	Agriculturist	54	16.27

Continued

	Student	24	9.23
	Technician	14	4.22
	Other	140	42.16
Monthly income (XAF)	<100,000	142	42.77
	50,000 - 100,000	126	37.95
	<50,000	64	19.28

3.2. Behavioral Characteristics

About half (50.60%) of the participants actively consumed alcohol, while only 11.45% of them smoked cigarettes. 57.83% did not do regular physical exercise (**Table 2**). The sexual behavior of 222 participants (66.87%) was low risk (they had only 1 sexual partner and did or did not always use condoms during intercourse). 92 participants (27.71%) recorded moderate risk sexual behavior (had more than one sexual partner and always or sometimes used condoms), while the remaining 18 participants (5.42%) recorded high risk sexual behavior (had more than one sexual partner and never used condoms). The majority (41.57%) of participants' partner relationships had more conflict than comfort, while about half of them (57.23%) identified ED as a complication of the diabetes they had (**Table 2**).

Table 2. Behavioral characteristics of participants

Characteristics	Category	Frequency (n)	Percentage (%)
Alcohol consumption	Yes	168	50.6
	No	164	49.4
Cigarette smoking	Yes	38	11.55
	No	294	88.55
Physical exercise	Yes	140	42.17
	No	192	57.83
Sexual behavior	Low risk	222	66.87
	Moderate risk	92	27.7
	High risk	18	5.43
Partner relationship	More conflict than comfort	138	41.57
	Equally both	104	31.33
	More comfort than conflict	90	27.11
Knowledge of ED as diabetic complication	Correct knowledge	190	57.23
	No knowledge	118	35.54
	Incorrect knowledge	24	7.23
Total		332	100

3.3. Clinical Characteristics

Most participants (290 participants, 87.35%) had type 2 DM (**Figure 1**), with the duration of disease between 2 - 5 years being the most frequent. About a third of participants (31.07%) were on one or more other drugs such as anti-hypertensives, traditional therapy, highly active anti-retroviral drugs (HAART) or others (aspirin, statins, antacids) besides their routine anti-diabetic medications. 54.32% of participants had at least one chronic disease, with retinopathy and hypertension being the most frequent (**Table 3**).

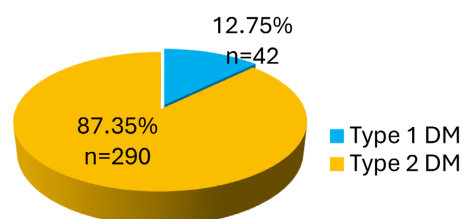


Figure 1. Diabetes mellitus type among participants.

Table 3. Clinical characteristics of participants.

Variable	Sub type	Frequency (n)	Percentage (%)
DM duration	<1	60	18.07
	2 - 5	138	41.57
	>5	134	40.36
Other drug use	YES	N = 106	31.93
	Anti-hypertensives	54	51.92
	Traditional therapy	44	42.31
	HAART	2	1.92
	Others	6	3.85
	NO	N = 226	68.07
Chronic disease	YES	N = 180	54.32
	Hypertension	80	24.1
	Retinopathy	100	30.12
	CKD	14	4.22
	Others	80	24.1
	NO	N = 152	45.78
Total		332	100

3.4. Biological Characteristics

Most of the participants were overweight (43.90%). 71.69% had normal blood pressure, 68.67% had elevated blood sugar and 64.55% had elevated glycated haemoglobin (**Table 4**).

Table 4. Biological characteristics of ED in study population.

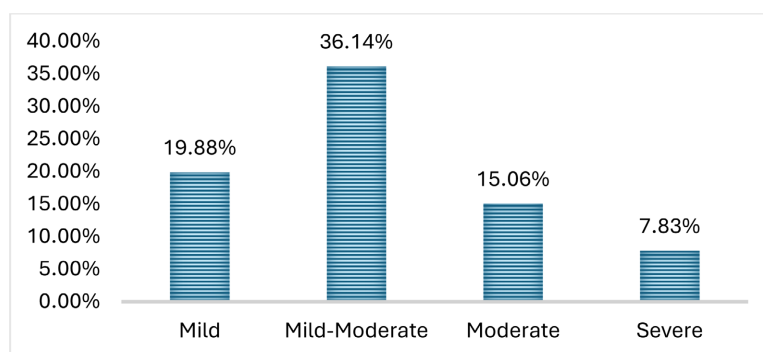
Variable	Subtype	Frequency	Percentage
BMI	Underweight	6	1.81
	Normal	132	39.76
	Overweight	146	43.9
	Obese	48	14.73
Blood pressure	Normal	238	71.69
	Elevated	94	28.31
Blood sugar	Normal	104	31.33
	Elevated	228	68.67
Glycated haemoglobin	Normal	116	35.15
	Elevated	214	64.55
Total		332	100

3.5. Prevalence of Erectile Dysfunction in the Study Population

Of the 332 participants, 262 participants had ED i.e. reported an IIEF score of 21 or less, which correlates to prevalence of 78.92%, at a 95% confidence interval and within a 6.21% error margin (**Table 5**). Among those who had ED, the majority had mild to moderate ED, followed by mild, moderate then severe ED (**Figure 2**).

Table 5. Prevalence of ED.

Variable	Frequency (n)	Percentage (%)
ED	262	78.92
No ED	70	21.08
Total	332	100

**Figure 2.** ED severity types.

3.6. Determinants of Erectile Dysfunction in the Study Population

In this study, determinants were grouped into 3: behavioural, biological and clinical domains. A logistic regression model was used to test for association between

these domains and ED. Significance between a variable and ED will be computed with the use of Confidence Interval. Factors whose intervals crossed 0 were considered non-determinants of the outcome (ED), while factors whose intervals did not cross 0 were considered significant determinants of ED. The results show that for each unit of alcohol consume we expect a -0.1467 increase in the expected value of the outcome (ED) in the log odds scale, given that all of the other variables in the model are held constant. The level of partner relationship was investigated for its association with ED showed that neither having more conflict than comfort or equally both was significantly associated with ED. For each increase in conflict level, a -0.3943 increase in ED is observed. High risk sexual behaviour was associated with a 0.3240 increase in ED though not statistically significant (**Table 6**).

Table 6. Behavioural factors and association with ED.

Predictive variable	Value	Std. Error	t value	2.5 % CI	97.5% CI
Alcohol consumption	-0.1467	0.2045	-0.7173	-0.5489192	0.2537377
Cigarette smoking	-0.1985	0.3233	-0.6141	-0.8406298	0.4331497
Partner relationship—More conflict than comfort	-0.3493	0.358	-0.9756	-1.0531148	0.3528082
Partner relationship—Equally both	-0.1924	0.3706	-0.5191	-0.9201032	0.5350799
High risk sexual behaviour	0.324	0.6356	-0.5098	-0.840886	0.4078574
Moderate to high-risk sexual behaviour	-0.2149	0.3179	0.6758	-0.9094282	1.6059187

3.6.1. Biological Factors

Of the four biological determinants, age, FBS and HbA1c were found to be positive determinates of ED (**Table 7**). The result showed that for every one-year increase in age, we expect a 0.04199 increase in the expected value (occurrence of ED, decrease in IIEF score) of the outcome (ED) in the log odds scale, given that all of the other variables in the model are held constant. For a one-unit (1 mg/dl) change in blood sugar (moving from elevated to normal blood sugar level), we

Table 7. Biological factors and association with ED.

Coefficients	Value	Std. Error	t value	25% CI	95% CI
Age	0.04199	0.01419	2.96007	0.01439591	0.0701375
BMI	-0.10341	0.08953	-1.15496	-0.27996342	0.07268261
BMI—Obese	0.38207	0.93099	0.41039	-1.44873177	2.20970908
BMI—Overweight	0.58801	0.49858	1.17938	-0.39075188	1.5702702
BMI—Underweight	-0.0585	1.07125	-0.05461	-2.19933521	2.08449368
Blood sugar	-0.77085	0.32236	-2.39124	-1.41065397	0.1445547
HbA1c	-1.24354	0.32789	-3.79261	-1.89580943	0.6079716

expect a -0.77085 decrease in the expected value of ED on the log odds scale, given all of the other variables in the model are held constant. Similarly, for HbA1c, we expect a -1.24354 increase in the expected value of ED, for every unit increase of the HbA1c value.

3.6.2. Medical Factors

In this study, no medical factors investigated were significantly associated with ED. Though the results showed that DM type 2 was associated with an increased risk of 0.8458 for developing ED, likewise duration of diagnosis which was associated with a 1.12312 increased risk in developing ED and a risk of -0.02319 for developing ED in patients with comorbidity (Table 8). However, none of these findings had a statistically significant association with developing ED in the study population (Table 8).

Table 8. Medical factors and association with ED.

Coefficients	Value	Std. Error	t value	2.50%	97.50%
DM type 2	0.84585	0.46	1.83881	-0.0523496	1.7581735
DM type 1	0.4853	0.4684	1.72341	1.7407708	0.5242042
Duration of diagnosis	1.12312	0.3094	3.62971	-0.4993749	0.5317685
Chronic disease (CD)	-0.02319	0.3261	-0.07113	-0.6640861	0.6166947
CD—Hypertension	0.3846	0.2847	1.35107	-0.1727722	0.9457805
CD—CKD	-0.47306	0.4853	-0.97477	-1.445071	0.4823657
CD—Retinopathy	-0.07628	0.2833	-0.26923	-0.6329294	0.4801276

4. Discussions

This cross-sectional study investigates the prevalence and determinants of erectile dysfunction (ED) among 332 adult male diabetic patients in two regional hospitals in Southwest Cameroon. The study found a high prevalence of ED (78.92%) with age, fasting blood sugar (FBS), and glycated hemoglobin (HbA1c) identified as significant determinants. Behavioral factors like alcohol consumption, smoking, and physical activity were not associated with ED. The study highlights the need for increased awareness and improved management of diabetic ED in this population.

4.1. Prevalence of Erectile Dysfunctions

ED is a diabetic complication that affects sexual, reproductive, physical and mental health and overall quality of care. In this study, we sought to determine its prevalence, determinants and some aspects of care, within the population of diabetic patients who attend the Limbe and Buea Regional hospitals.

Of the 332 participants included in our study, 262 had some form of ED, giving a prevalence of 78.92%. This prevalence is within the reported global range of 30% - 90%. The high value is like the results of other studies carried out in Ethiopia,

Nigeria, Iran and other parts of the world [5] [6] [9] [13]. It is however lower than the 95% prevalence recorded by Kemp *et al.* [8] in South Africa. This difference could be because the latter carried out their study at a tertiary hospital, more likely to have patients with advanced complications of the disease. Also, their population was predominantly older (mean age = 62 years) compared to ours (mean age = 55 years). Our prevalence was higher than the 51% reported by Selvin *et al.* [14] in USA and Reuben *et al.* [9] in Tanzania. The US study used the one-item questionnaire which could have underestimated the prevalence while in Tanzania, socioeconomic and methodological differences could account for their lower prevalence.

Concerning the differential types of ED according to severity, our study revealed that most men with ED had mild-moderate and mild disease, while the minority had moderate and severe ED. This corroborates the findings of Seid *et al.* [6] but is opposite to what Kemp *et al.* [7] reported. In the latter's study, most diabetic men with ED had severe ED. The fact that the latter's study population was dominated by older participants could equally explain this difference.

4.2. Determinants of Diabetic Erectile Dysfunction

From this study, we established that, alcohol consumption, cigarette smoking, and physical activity were not associated with occurrence of ED in this study. Same findings were reported by Ahmed *et al.* [2] in Egypt and Sharifi F *et al.* [11] in Iran. This however contradicts other studies [15] which recorded significant associations between each or both of these variables, with the occurrence of ED. This can be explained by the fact that the present study did not account on whether those who reported to be smokers were current smokers or had smoke in the past. It equally did not examine the relationship between amount smoked and erectile dysfunction in current smokers.

From scientific literature, risky sexual behaviour increases risk of Sexually Transmitted Infections (STI's); which in turn increase risk for ED. However, our study failed to identify any association between ED and high-risk sexual behaviour among diabetic patients. This could be because STI's in men are usually symptomatic, compared to women. Therefore, if they develop STI's they are more likely to be aware and seek treatment; avoiding the situation of chronic, untreated STI's which is responsible for ED.

The level of respondent's relationship with their sexual partner and found that neither "more conflict than comfort" or "equally both" had an effect on the occurrence of ED from our study, suggesting that ED onset among diabetic patients is more organic than psychogenic and that conflicting partner relationships with diabetic patients is more the consequence than the cause of ED.

Regarding the biological factors studied, the presence and severity of ED was significantly higher among patients with elevated FBS and HbA1c, confirming the mediation of hyperglycemia in the pathogenesis of ED. These findings corroborate what is reported in literature [14] [16] [17]. The association between glycemic

control and ED explains the high prevalence of ED recorded in our study, as over half of the respondents (64.85%) had poor glyemic control (using HbA1c cut-off of >7%).

We found increase in age to be a significant determinant of both ED occurrence and severity. This is constant across other scientific literature [6]-[8] [11]. The decline in male sex hormones as well as physiological testicular changes that come with age have been reported to be responsible for this association.

The type of DM the respondent had was not found to be a determinant of ED, in this study. Similar results were reported by Roth *et al.* [15] in Israel. However, Kemp *et al.* [7] found an association between DM type 2 and ED. This could be due to the difference in age groups affected by each type of DM. Type 1 DM patients are of a younger age group than type 2, and age itself is a determining factor for ED, so these could be why type 2 DM can appear to have an association with ED in contrast to type 1 DM.

The duration of disease was not associated with occurrence of ED in this study. This was not the case with either the studies by Ziaei-Rad *et al.* [13] in Iran or Zheng *et al.* [12]. Two reasons can explain these differences. Longer duration of diagnosis reported to be an association of diabetic ED only considered the duration of disease from a doctor's diagnosis, which can be significantly shorter than the duration from the actual onset of disease; and it is this duration from disease onset that determines the duration of pathology that causes ED. Therefore, it could be that in our study, late diagnosis of DM (which is common in our setting), was masked as shorter duration of disease, which would mean that, both those with long and short disease durations may have had the same duration of pathology and hence the same chances for the occurrence of ED.

Even though a good number of respondents had either hypertension or retinopathy, our study found no significant association between the presence of these diseases and the occurrence of ED. The co-existence of these diseases with diabetes corroborates literature, but the absence of a predictive capacity of the co-morbidities for diabetic ED does not [16] [17]. This could be explained by the fact that the ability of a particular co-morbidity to influence ED is based on the duration and magnitude of its pathological process, determined by disease duration, control and medications amongst others. These factors occur differently across patients with the same co-morbidity and could be why the same co-morbidity may induce ED in one patient and not the other.

5. Limitations and Strengths

This study did not incorporate physiological measurements of erectile function (e.g., nocturnal penile tumescence) to complement self-reported data and improve the accuracy of ED assessment which could have over or underestimated the prevalence of ED in this study. Serum testosterone levels were not measured.

The significance of the findings of this study is strengthened by the fact that our sample included men from a wide age range and that we were able to control for

many of the established risk factors for erectile dysfunction, including age, co-morbidities and alcohol use. However, we acknowledge the need to exercise caution in making inferences about causality based on cross-sectional surveys of this kind.

6. Conclusion

Among male patients with diabetes at the Limbe and Buea Regional Hospitals, this study identified that: The prevalence of diabetic ED in our hospital population is 78.92, with 19.88% being mild, 36.14 being mild-moderate, 15.06% being moderate and 7.83% being severe. Age, Fasting Blood Sugar and Glycated Haemoglobin are positive determinants of diabetic ED. We realize that most of the factors that contribute to the high prevalence and suboptimal care of diabetic ED, such as poor glycemic control. This tells us that collective effort is required to reduce prevalence and improve awareness, recognition and care of diabetic ED.

Availability of Data and Materials

All the data and supporting files are in the articles.

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Authors' Contributions

D.E: participated in Conceptualization of the topic, Methodology, Investigation, Formal analysis, Writing—review & editing, and Supervision of the manuscript.

C.K: participated in Conceptualization of the topic, Methodology, Writing—review & editing.

O.N: participated in Conceptualization of the topic, Methodology, Formal analysis, Writing—review & editing the manuscript.

G.T.: participated in Conceptualization, Formal analysis, Investigation, Writing—review & editing.

B.A.: Writing—review & editing.

F.A.: Writing—review & editing.

Ethical Approval and Consent to Participate

The study was performed in accordance with the Declaration of Helsinki and approved by appropriate ethics committee. Ethical clearance obtained from the Faculty of Health Sciences Institutional Review board of the University of Buea. Informed consents were obtained from participants prior to data collection. All data were anonymized before the authors received the data. All methods were performed in accordance with the relevant guidelines and regulations.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Abbreviations

<i>ED:</i>	Erectile Dysfunction.
<i>DM:</i>	Diabetes Mellitus.
<i>IIEF:</i>	International Index of Erection.
<i>BMI:</i>	Body Mass Index.
<i>HbA1C:</i>	Glycated Hemoglobin.
<i>CI:</i>	Confidence Interval.
<i>SBP:</i>	Systolic Blood Pressure.