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Prevalence of Diabetes Mellitus and Its Complications at Hoima Regional Referral Hospital

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ABSTRACT

Uganda has seen an increase in diabetes cases as well. The incidence is 1.4%, however the Eastern Region has seen prevalence rates as high as 7.4%. As indicated by the insufficient (poor) diabetes care found particularly in rural regions, the financial burden of diabetes is quite large and constantly growing, a burden that hurts the Ugandan economy. The goal of this study was to determine how common diabetes mellitus and its consequences are at Hoima Regional Referral Hospital. Using patient data who visited the hospital between January 2020 and December 2020, a facility-based retrospective cross-sectional study was carried out at the Hoima regional referral hospital in Western Uganda. The files that will be examined were selected using a straightforward random sample technique. Microsoft Excel 13.0 was used to enter the data into the computer and STATA version 14.0 was used to analyze it. The complications associated with diabetes mellitus were identified using bivariate logistic regression; odds ratios were presented together with the 95% confidence interval p value, which indicated significance. Participants in the study were 43.02 years old on average, with a standard deviation of 17.07 years. With an interquartile range of 29 to 56 years, the median age was 40 years. At a 95% confidence interval of 19.46 to 29.49, the total prevalence of diabetes mellitus was 24.48% (70/286). The age group of 71 years had the highest prevalence of Diabetes Mellitus, with a prevalence of 36.36% at a 95% confidence interval of 14.53-58.19, while the age group of 51 to 60 years had the lowest prevalence, with 19.51% at a 95% confidence interval of 06.85-32.18. The research revealed that diabetes mellitus was linked to 4 sequelae, including cardiovascular disease (cOR 2.18, 95% CI 1.26-3.77, P=0.005) and neuropathy (cOR 2.31, 95% CI 1.31-4.06, P=0.004). Foot damage (cOR 23.82, 95%CI 11.98-47.35, P0.001) and retinopathy (cOR 1.91, 95%CI 1.05-3.48, P=0.034). At Hoima Regional Referral Hospital, the case fatality rate for diabetes mellitus cases over the course of a year was 14.29%. Compared to the overall prevalence of diabetes mellitus in Uganda, the prevalence of the disease at Hoima Regional Referral Hospital is greater. By initiating diabetic patients on anti-diabetics early enough, ensuring that they take the medication as prescribed, and providing them with self-management advice, it is possible to prevent all complications of diabetes mellitus.

Keywords: prevalence, diabetes mellitus, complications

INTRODUCTION

Diabetes mellitus is a chronic disease caused by inherited and/or acquired deficiency in production of insulin by the pancreas or by the ineffectiveness of insulin produced. Such a deficiency or ineffectiveness of insulin results in increased blood glucose concentration which in turn damage many the body's systems in particular the blood vessels

and nerves [1]. Two principle forms of diabetes mellitus exists namely; type 1 and type 2 formerly called insulin dependent diabetes mellitus(IDDM) and non- insulin dependent diabetes mellitus(NIDDM) respectively of which type 2 is the one mostly associated with HIV/AIDS patients [2]. The chronic hyperglycaemia of diabetes is associated with long-term damage, dysfunction, and failure of different organs, especially the eyes, kidneys, nerves, heart, and blood vessels [3, 4, 5].

With the change in lifestyle that accompanies improvement in earning, the prevalence of Diabetes Mellitus (DM) (especially type 2 DM) has increased in tandem due to an increase in the number of people, especially in Africa, who led a more sedentary, high-calorie-intake life [6].

Diabetes is a serious health condition associated with increased morbidity and mortality. According to the World Health Organization 2016 global report on diabetes, there were an estimated 422 million adults living with diabetes in 2014, with an estimated global prevalence of 8.5%. Prevalence has almost doubled from the rate of 4.7% in 1980 [1, 7]. ADA publishes annual evidence-based diabetes standards of care practice guidelines to optimize the quality of care and health outcomes of people living with diabetes [8].

As a result of the increased prevalence of diabetes, complications also have become more common and the physician has to deal with diabetes complications more now than ever before [9, 10]. Possible complications include heart attack, stroke, kidney failure, leg amputation, vision loss and nerve damage. In pregnancy, poorly controlled diabetes increases the risk of foetal death and other complications [11, 12, 13, 14]. Diabetes and its complications causes significant economic loss to people with diabetes and their families, and to health systems and national economies through direct medical costs and loss of work and wages [15]. About 673 billion US dollars (12% of the global health expenditure is spent on diabetes).While the major cost drivers are hospital and outpatient care, a contributing factor is the rise in cost for analogue insulins which are increasingly prescribed despite little evidence that they provide significant advantages over cheaper human insulin [16].

METHODOLOGY

Study design

A retrospective facility-based cross-sectional study design was conducted utilizing quantitative methods of data collection.

Study area

The study was conducted at Hoima Regional Referral Hospital which is located in Hoima District.

Study population

The study population was all patients admitted in the male and female medical wards of Hoima Regional Referral Hospital within the time scope of the study

Sampling Technique

Simple random sampling was used as the sampling technique for this study. According to [17] simple random sampling involves choosing the respondents haphazardly without following any specific procedure. With this method, the researcher defined the population, chose the sample size, listed the population, numbers were assigned to the units, random numbers were found and files of the samples were selected. The aim of the simple random sample was to reduce the potential for human bias in the selection of cases to be included in the sample. Each of the files of diabetic patients had equal chances of being selected to be included in the study.

Sample size determination

Being a retrospective cross-sectional study, which involved review of patient records, all the files of patients admitted in the medical wards of HRRH and attended between January 2020 to December 2020 were used in the study.

Inclusion criteria

All files of patients admitted and treated in the medical wards of HRRH within the time scope of the study will be used for the study.

Exclusion criteria

- All files of patients admitted and treated in the medical wards with unclear and unverifiable data will be excluded.

Study procedure

Fisher's formula will be used to determine the Sample size

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

Where,

n = Minimum sample size

Z = The table value for standard normal deviation corresponding to 95% significance level (=1.96)

P = Prevalence of characteristic being estimated
d = Margin error, set at 0.05
The sample size of this study will be calculated using the estimated prevalence of 50% based on since there was no similar study done in the local context and the value used for P will be 50%.

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

$$n = \frac{(1.96)^2\, 0.5(1-0.5)}{(0.05)^2}$$

$$n = \frac{3.8416\ x\ 0.5\ x\ 0.5}{0.0025}$$

$$n = \frac{3.8416\ x\ 0.25}{0.0025}$$

$$n = 384$$

From above, our sample size was 364 participants but only 286 patient files were used in the study

Data collection Instruments

A data collection instrument provided a guide to the researcher to collect adequate data that was useful in answering the research questions to achieve the study objectives. The researchers used questionnaires as the main data collection tool. A questionnaire refers to a written form of questions that are systematically arranged to enable the researcher come up with clear findings that can answer the research questions. Data was collected in a semi-structured questionnaire containing sections for socio-demographic characteristics, prevalence of diabetes mellitus, complications of diabetes mellitus and lastly the case fatality of diabetes mellitus.

Data analysis plan

Descriptive statistics of frequencies and percentages were calculated for categorical variables and presented in the form of figures, tables and texts. Continuous variables were described in median (inter- quartile range, IQR) and categorical variables were described in percentages. Continuous variables were compared using Mann-Whitney test and categorical variables were compared using Chi-square test or Fischer's exact test as appropriate.
The prevalence of diabetes mellitus at Hoima Regional Referral Hospital was analyzed in terms of frequency and percentage with a 95% confidence interval and information was summarized in form of tables, pie charts and narrations.

Ethical considerations

For this study to be ethical [18], the researcher put the following under his consideration.

RESULTS

The socio-demographic characteristics of patients who records were used are shown in table 1 below. It can be observed that that majority of the study participants 28.32% (81/286) were in the age group of 18 – 30 years, belonged to Catholic Religion 35.66% (102/286) living in rural areas of residence 60.14% (172/286), were married 66.78% (191/286), having no education 36.01 (103/286), were employed 65.38% (187/286) and had their ancestral homes in Western Uganda 56.99% (163/286). Furthermore, results showed that minority 07.69% (22/286) of the study were in the age group of 71 years and above belonging to Born again religion 07.34% (21/286), resided in urban areas of residence 39.86% (114/286), were cohabiting 04.90% (14/286), and had attained primary level of education 15.03% (43/286) meanwhile 34.62% (99/286) were unemployed and 13.29% (38/286) had their ancestral homes in Northern Uganda.

Table 1; Shows Frequency distribution for socio-demographic Characteristics of the Study Participants.

Variable	Frequency (n)	Percentage (%)
Age in years		
18 – 30	81	28.32
31 – 40	64	22.38
41 – 50	49	17.13
51 – 60	41	14.34
61 – 70	29	10.14
≥71	22	07.69
Religion		
Catholic	102	35.66
Anglican	90	31.47
Muslim	27	09.44

Variable	Frequency (n)	Percentage (%)
Born Again	21	07.34
Others	46	16.08

Continuation of table 1

Area of Residence		
Urban	114	39.86
Rural	172	60.14
Marital Status		
Single	45	15.73
Married	191	66.78
Cohabiting	14	04.90
Divorced	36	12.59
Education		
None	103	36.01
Primary	43	15.03
Secondary	73	25.52
Tertiary	67	23.43
Employment Status		
Employed	99	34.62
Unemployed	187	65.38
Ancestral Region		
Northern	38	13.29
Western	163	56.99
Eastern	28	09.79
Central	57	19.93

Descriptive summary statistics of age of study participants are shown in table 2 below. The mean age of the study participants was 43.02 years with a standard deviation of 17.07. The median age was 40 years with an inter-quartile range of 29 years to 56 years. The minimum age was 18 years whereas the maximum age was 80 years. The data on age of the participants had a variance of 291.49 with a positive skewness of 0.49 and a kurtosis of 2.23.

Table 2; Descriptive statistics of age of study participants.

Observations	Mean	Std Dev	Median	IQR	Min	Max	Variance	Skewness	Kurtosis
286	43.02	17.07	40	29, 56	18	80	291.49	0.49	2.23

Std Dev = Standard Deviation, Min = Minimum, Max = Maximum, IQR = Inter quartile Range

Table 3 shows the overall prevalence of diabetes mellitus among the study participants. As observed from the table, the prevalence of diabetes mellitus was 24.48% (70/286) at a 95% CI of 19.46 – 29.49.

Table 3: The Overall Prevalence of Diabetes Mellitus

Diabetes Mellitus	Frequency (n)	Percentage (%)	95% Confidence Interval
No	216	75.52	70.51 – 80.54
Yes	70	24.48	19.46 – 29.49

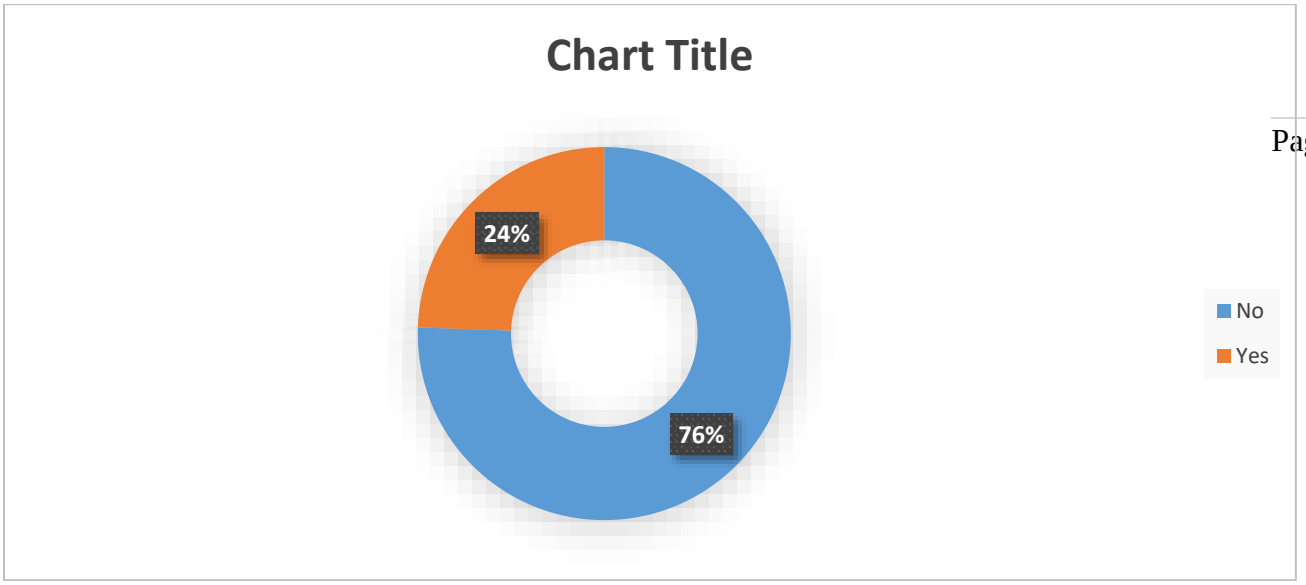

Figure 1: A Doughnut Chat Showing the Overall Prevalence of Diabetes Mellitus

Table 4 below shows the type of diabetes mellitus which the study participants were suffering from. Out of the 70 study participants who had Diabetes Mellitus, Majority 82.86% (58/70) were found to be having Type 2 Diabetes at a 95% CI of 73.81 – 91.91Mellitus meanwhile 17.14% (12/70) had Type 1 Diabetes Mellitus at a 95% CI of 08.09 – 26.19.

Table 4; Type of Cervical Cancer Screening Done

Type of Diabetes	Frequency (n=70)	Percentage (%)	95% Confidence Interval
Type 1 DM	12	17.14	08.09 – 26.19
Type 2 DM	58	82.86	73.81 – 91.91

Shown in table 5 is the age specific prevalence of Diabetes Mellitus among the study participants. It can be observed that the age group with the highest prevalence of Diabetes Mellitus was the age group of ≥71yearshaving a prevalence of 36.36% at a 95% CI of 14.53-58.19 meanwhile the lowest prevalence was observed in the age group of 51 – 60 years having a prevalence of 19.51% at a 95% CI of 06.85-32.18. The difference in the prevalence of Diabetes Mellitus across the different age groups was not statistically significant as the p value was more than 0.05.

Table 5: Age-Specific Prevalence of Diabetes Mellitus

Age of the participants in Years	Total	Diabetes Mellitus		Chi Square (X^2)	P Value
		No Count, % (95% CI)	Yes Count, % (95% CI)		
18 - 30 years	81	62 76.54% (67.12-85.97)	19 23.46% (14.03-32.88)		
31 - 40 years	64	47 73.44% (62.32-84.56)	17 26.56% (15.44-37.68)		
41 - 50 years	49	39 79.59 % (67.90-91.29)	10 20.41% (08.71-32.10)		
51 - 60 years	41	33 80.49 % (67.82-93.15)	08 19.51% (06.85-32.18)		

61 - 70 years	29	21 72.41 % (55.11-89.72)	08 27.59% (10.28-44.89)	3.015	0.698
71 or + years	22	14 63.64 % (41.81-85.47)	08 36.36% (14.53-58.19)		

CI = Confidence Interval, p Value is Significant at 0.05 level

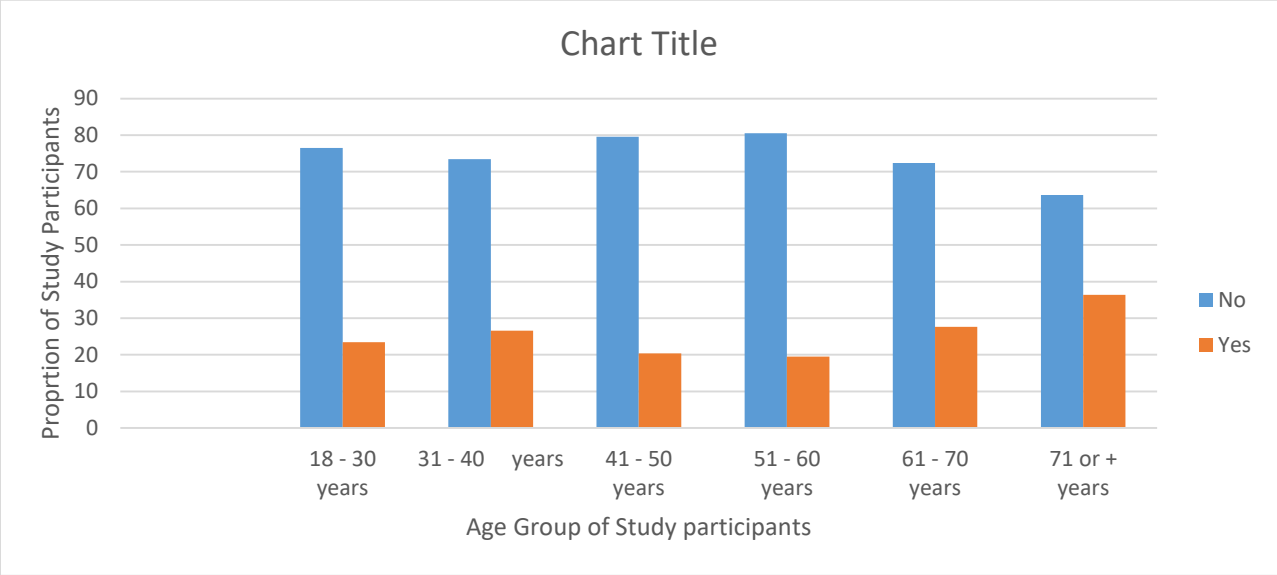

Figure 2: Age-Specific Prevalence of Diabetes Mellitus

Table 6 below shows the distribution complications among study participants irrespective of whether they had diabetes mellitus or not. Results showed that 42.66% (122/286) had cardiovascular diseases, 29.02% (83/286) had neuropathies, 23.43% (67/286) had nephropathies, 23.43 (67/286) had retinopathies, 27.27% (78/286) were suffered foot damage, more than half of the study participants 54.55% (156/286) had skin conditions, 21.33% (61/286) had hearing impairment, 31.47% (90/286) had Alzheimer's Disease and lastly 30.42% (87/286) had depression.

Table 6: The frequency distribution of Complications among the Study Participants

Complications	Frequency (n)	Percentage (%)
Cardiovascular Disease		
Yes	122	42.66
No	164	57.34
Nerve Damage (Neuropathy)		
Yes	83	29.02
No	203	70.98
Kidney Damage (Nephropathy)		
Yes	67	23.43
No	219	76.57
Eye Damage (Retinopathy)		
Yes	67	23.43
No	219	76.57
Foot Damage		
Yes	78	27.27
No	208	72.73
Skin Conditions		
Yes	156	54.55
No	130	45.45
Hearing Impairment		

Complications	Frequency (n)	Percentage (%)
Yes	61	21.33
No	225	78.67
Alzheimer's Disease		
Yes	90	31.47
No	196	68.53
Depression		
Yes	87	30.42
No	199	69.58

A bivariate logistic regression was run to establish the complications which have associations with diabetes mellitus among the study participants and the results are presented in table 7 below. Results of the analysis showed that 4 complications had statistical associations with Diabetes Mellitus, namely: Cardiovascular diseases, Neuropathy, Retinopathy and Foot Damage. Study participants who had cardiovascular diseases were 2.18 times more likely to be diabetic compared to those who never had cardiovascular diseases (cOR 2.18, 95%CI 1.26-3.77, P=0.005). Those who had neuropathy were 2.31 times more likely to be diabetic than those who never had neuropathy (cOR 2.31, 95%CI 1.31-4.06, P=0.004). Patients who had retinopathy had 1.91 folds the odds of having diabetes mellitus than their counterparts who never had retinopathy (cOR 1.91, 95%CI 1.05-3.48, P=0.034) and lastly, patients who had foot damage were 23.82 times more likely to be having diabetes mellitus compared to their counterparts who never had foot damage (cOR 23.82, 95%CI 11.98-47.35, P<0.001).

Table 7: Results of Bivariate Analysis to show The Complications Associated with Diabetes Mellitus among study Participants

Complications	Diabetes Mellitus		cOR (95% CI)	P Value
	No Count, (%)	Yes Count, (%)		
Cardiovascular Disease				
Yes	82 (67.21)	40 (32.79)	2.18 (1.26-3.77)	**0.005**
No	134 (81.71)	30 (18.29)	Reference	
Nerve Damage (Neuropathy)				
Yes	53 (63.86)	30 (36.14)	2.31 (1.31-4.06)	**0.004**
No	163 (80.30)	40 (19.70)	Reference	
Kidney Damage (Nephropathy)				
Yes	51 (76.12)	16 (23.88)	Reference	
No	165 (75.34)	54 (24.66)	1.04 (0.55-1.98)	0.897
Eye Damage (Retinopathy)				
Yes	44 (65.67)	23 (34.33)	1.91 (1.05-3.48)	**0.034**
No	172 (78.54)	47 (21.46)	Reference	
Foot Damage				
Yes	25 (32.05)	53 (67.95)	23.82 (11.98-47.35)	**<0.001**
No	191 (91.83)	17 (08.17)	Reference	

Continuation of table 7

Skin Conditions				
Yes	122 (78.21)	34 (21.79)	Reference	
No	94 (72.31)	36 (27.69)	1.37 (0.80-2.36)	0.249
Hearing Impairment				
Yes	46 (75.41)	15 (24.59)	Reference	
No	170 (75.56)	55 (24.44)	0.99 (0.51-1.91)	0.981
Alzheimer's Disease				
Yes	67 (74.44)	23 (25.56)	Reference	
No	149 (76.02)	47 (23.98)	0.92 (0.52-1.63)	0.773
Depression				
Yes	67 (77.01)	20 (22.99)	Reference	
No	149 (74.87)	50 (25.13)	1.12 (0.62-2.03)	0.699

CI = Confidence Interval, cOR = Crude Odds Ratio, P Value is Significant at 0.05 level

As shown in table 8 below, the case fatality rate of Diabetes mellitus at Hoima Regional Referral Hospital was 14.29% in a period of one year.

Table 8: The Overall Case Fatality Rate of Diabetes Mellitus

Outcome	Frequency (n=70)	Percentage (%)	95% Confidence Interval
Alive	60	85.71	77.31 – 94.12
Dead	10	14.29	05.88 – 22.69

Table 9 below shows the case fatality rate (CFR) due to the various complications associated with Diabetes Mellitus. Cardiovascular rate had a CFR of 50.00%, Neuropathy had a CFR of 30.00%, the CFR of Nephropathy was 40.00% meanwhile CRF of Retinopathy was 30.00%. Furthermore, Foot Damage had a CFR of 80.00%, the CFR of skin conditions were at 60.00% whereas CFR of hearing impairment was at 20.00%. Similarly, Alzheimer's disease had a CFR of 20.00% meanwhile depression had a CFR of 40.00%.

Table 9: The Case Fatality Rate of Complications Due to Diabetes Mellitus

Complications	Presence of Complication					
	Yes			No		
	Count	%	95%CI	Count	%	95%CI
Cardiovascular Disease	05	50.00	12.30-87.70	05	50.00	12.30-87.70
Neuropathy	03	30.00	-04.56-64.56	07	70.00	35.44-100.05
Nephropathy	04	40.00	03.06-76.94	06	60.00	23.06-96.94
Retinopathy	03	30.00	-04.56-64.56	07	70.00	35.44-100.05
Foot Damage	08	80.00	49.84-100.10	02	20.00	-10.16-50.16
Skin Conditions	06	60.00	23.06-96.94	04	40.00	03.06-76.94
Hearing Impairment	02	20.00	-10.16-50.16	08	80.00	49.84-100.10

Alzheimer's Disease	02	20.00	-10.16-50.16	08	80.00	49.84-100.10
Depression	04	40.00	03.06-76.84	06	60.00	23.06-96.94

DISCUSSION

This study showed that the prevalence of diabetes mellitus was 24.48% (70/286) at a 95% CI of 19.46 – 29.49. This is higher than what was found in a meta-analytical study conducted in China in 2014 which revealed that region-pooled prevalence was highest in the eastern region (8.0%, 95% CI: 6.1-10.0%) and lowest in the Western region (4.6%, 95% CI: 3.3-6.0%) [19]. The discrepancy in the study findings can be attributed to the difference in the study designs in that the previous study was meta-analysis meanwhile the present study was a hospital based retrospective cross-sectional study. Contrary to the findings of the present study, a follow-up study conducted in 2013 by Wang and colleagues reported that among the Chinese adult population, the estimated standardized prevalence of total diagnosed and undiagnosed diabetes was 10.9% (95% CI, 10.4%-11.5%); that of diagnosed diabetes, 4.0% (95% CI, 3.6%-4.3%) [20]. These findings are all lower than what was found in the current study and this variation could be due to difference in socio demographic characteristics as well as lifestyle of the study participants since Diabetes Mellitus has been known to be a lifestyle disease. The result of the present study is not in line with the results of a Ugandan Based study which revealed that the prevalence of Diabetes in Eastern Uganda in 2013 was 7.4% (95%CI 6.1-8.8), using WHO criteria and 20.2% (95%CI 17.5-22.9) with ADA criteria [21].The discrepancy in the study findings is probably due the variation in the age category recruited in the study whereby the presented study considered participants aged 18 years and above meanwhile the previous study had a cut off from 35 years to 60 years. Another study conducted in Kasese District on the prevalence of non-communicable diseases reported the prevalence of diabetes to be 9 % [22], which is lower than the 24.48% found in the present study probably because of the difference in the study periods of the 2 studies. In a wider geographical region unlike the present study which was limited to one hospital. A population-based national survey, studied the prevalence and correlates of diabetes mellitus in Uganda. Results revealed that the overall prevalence of diabetes mellitus was 1.4% (95% CI 0.9–1.9%). The prevalence of diabetes mellitus in the urban areas was 2.7% (95% CI 1.4–4.1%), while the prevalence was 1.0% (95% CI 0.5–1.6%) in the rural areas [23] . All these figures are lower than what was found in the present study probably because the participants of the present study were more exposed to risk factors for Diabetes Mellitus. Neuropathy: Results of the study showed that those who had neuropathy were 2.31 times more likely to be diabetic than those who never had neuropathy. This is in agreement with a Chinese study back in 2010 which revealed neuropathy was one of the complications linked to Diabetes Mellitus [24]. The result of the present study is in line with results of a study conducted from Spain which revealed that neuropathy was linked to diabetes mellitus [25]. Diabetic neuropathy is the most common type of neuropathies. It affects patients with both type 1 and type 2 diabetes, but it progresses more rapidly and its manifestations are more severe in type 1 diabetes [26]. Researchers think that over time, uncontrolled high blood sugar damages nerves and interferes with their ability to send signals, leading to diabetic neuropathy [27]. High blood sugar also weakens the walls of the small blood vessels (capillaries) that supply the nerves with oxygen and nutrients [28]. Diabetic retinopathy (DR) is the most frequent complication of diabetes and remains the leading cause of preventable blindness in the working-age population in developed countries [29, 30]. DR has long been considered a microvascular complication of diabetes; however, growing evidence suggests that neurodegeneration is an early event in its pathogenesis [31, 32]. There is robust evidence regarding the relationship between blood glucose levels and the development and progression of DR. Intensive versus conventional glycaemic management was associated with a 39% reduction in the risk of laser photocoagulation in the type 2 diabetic population of the UKPDS [33]. Tight versus less tight glycaemic control in the type 1 diabetic population of the Diabetes Control and Complications Trial (DCCT) reduced the risk of new retinopathy by 76% and of the progression of existing retinopathy by 54% [34]. Individuals with diabetes have a 2–3 folds risk of all-cause mortality [35]. Presence of diabetes is associated with increased mortality from infections, cardiovascular disease, stroke, chronic kidney disease, chronic liver disease, and cancer [36, 37]. In addition, although progress has been made in promoting population health and extending life expectancy, diabetes is the second biggest negative total effect on reducing global health adjusted life expectancy worldwide [38].

Unlike the present study which determined the case fatality of diabetes mellitus for only one year, [39] studied the case fatality of diabetes mellitus in Latvia for a period of 12 years and found that mortality in a population with diabetes decreased statistically significantly from 57.76 per 1000 py in 2000 to 45.33 per 1000 py in 2012.

CONCLUSION

The prevalence of diabetes mellitus at Hoima Regional referral hospital is higher than the national prevalence of diabetes mellitus in Uganda. The study has concluded that cardiovascular diseases, Neuropathy, Retinopathy and Foot Damage were the complications which had statistical associations with Diabetes Mellitus.

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