Prevalence and Factors associated with Peripheral Neuropathies among Patients with Diabetes attending Jinja Regional Referral Hospital: A Retrospective open cohort study.

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Abstract

Aim

To determine the prevalence and factors associated with diabetic peripheral neuropathy among diabetic patients of Jinja Regional Referral Hospital**.**

Methodology

A retrospective open cohort study was conducted among 1000 diagnosed diabetic patients ofJRRH. Data on the socio-demographics, age, duration of symptoms, smoking, alcohol intake, HIV status, BMI, cholesterol levels, history of kidney disease, heart or brain problems, and footing problems were analyzed using multiple logistic regression. A p-value of < 0.05 was considered significant.

Results

The study revealed that the mean age of developing DPN was 51.1.674 (67.4%) of the patients obtained from the register were females and 324 (32.4%) were male.760 (76%) of the patients obtained from the register were of average BMI of 24 and 160 (16%) had a BMI of more than 25.540(54%) of the patients developed diabetic neuropathy while 460(46%) of the patients did not develop DNP. The factors associated with DPN were brain or heart problems X2=22.97, Eye problems X2=20.934, P=0.001, Kidney problems X2=22.97, P=0.001, High cholesterol X2=19.153, P=0.001, Alcohol intake X2= 35.224, P=0.001 and Adequate physical activity X2=1.349, P=0.001.

Conclusion

The Prevalence of DPN was high (54%) and occurs in 1 in every 6 DM patients in Jinja Regional Referral Hospital among patients with diabetes.

The factors associated with diabetic neuropathy among diabetic patients are; age, BMI, physical activities, sex, and underlying conditions like brain or heart problems, kidney problems, eye problems, and high cholesterol levels.

Recommendations:

Early diagnosis of DM with regular sugar monitoring would play a significant role in identifying these problems.

Keywords: Diabetic peripheral neuropathy, associated factors, diabetes mellitus, Submitted: 08th/10/2022 Accepted: 07th/11/2022

1. Background of the study:

Diabetes is a disease that exerts a huge societal burden by reducing the quality of life and life expectancy causing economic loss to individ-

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uals and the nation. It is divided into diabetes 1 which is insulin-dependent and diabetes 11 which is insulin-independent.

Peripheral neuropathy is a disorder of the peripheral nerves that send messages to the central nervous system. Chronic diabetes mellitus is associated with various complications like neuropathy, nephropathy, and encephalopathy. Diabetic neuropathy is the presence of symptoms of peripheral nerve dysfunction in diabetics after the exclusion of other causes. Diabetic Peripheral Neuropathy is characterized by pain, paresthesia, and sensory loss and affects 50% of people reducing their morbidity and mortality (Wong, Rupp, and Mermel, 2014).

Painful symptoms such as burning, tingling, shooting, or lancing are present in around one-third of the patients with diabetic peripheral neuropathy and around 20% of all diabetic patients. DPN starts in the toes and gradually moves proximally. Once it's well established in the lower limbs, it affects the upper limbs with sensory loss (Kramer, Schwebke, and Kampf, 2013).

Globally, there are 422million people having diabetes and the majority are living in low and middle-income countries, 1.5 million deaths are directly attributed to diabetes each year of which 50% develop diabetic neuropathy (WHO, 2019)

In Africa, the prevalence of diabetes is estimated to be 15.9 million adults with a regional prevalence of 3.1%. The African continent has the greatest proportion of people with undiagnosed diabetes and global projections show that it will experience the greatest future increase in the burden of diabetes (Moffat J et,2018).

In East Africa particularly in Kenya, the prevalence of diabetes is at 3.3% rate but also two-thirds of diabetic patients may be undiagnosed (WHO, 2019).

In Uganda, the prevalence of diabetes is 10.1% with the highest numbers in rural residents (16.1%) and periurban Ugandans at 7.6%. The majority of pre-diabetes is 13.8%.

However, these highlights give us a need for large-scale prospective studies to accurately quantify the burden of diabetes (Global Health Action, 2016).

According to the Centers for Disease Control (CDC), the rise in Diabetic neuropathy prevalence corresponds to the rise in diabetes around the world which is approximately 463 million adults aged between 20-76 years of which results in a prevalence of 8.8% who develop DN (CDC, 2020).

Across Africa, the prevalence of DN is 11% and the most typical risk is age, sex, and body mass index hypertension (WHO, 2015).

In East Africa, a study was also conducted in Tanzania to determine the prevalence and incidence rates of neuropathy among diabetic patients, and of the total 327 diabetic patients observed, 72.2% developed neuropathy (Joint national committee, 2019)

In Uganda, a survey done in Kanungu showed the prevalence of DPN at 18.7% which raised a public health concern causing an increase in the burden of the disease (Asimwe et al, 2018).

This study will therefore aim at evaluating the prevalence and associated factors of peripheral neuropathy among patients with diabetes and aim to reduce the enormous medical and socioeconomic burden.

The factors associated with diabetic peripheral neuropathy include Basal Metabolic Rate, several comorbid diseases such as chronic kidney disease, hypertension, dyslipidemia, cerebral vascular disease, age, smoking, HbA1c control, triglyceride, albumin, and diabetic retinopathy.

This study therefore will aim at determining the prevalence and associated factors of diabetic neuropathy among people with diabetes at Jinja regional referral hospital.

2. METHODOLOGY

2.1. Description of Study design

A retrospective open cohort study design was employed using quantitative methods of data collection because it focused on the health outcomes of the study.

2.2. ***Study setting***

The research was carried out at Jinja Regional Referral Hospital in Jinja district because

of the increase in the number of people with diabetes. . The diagnosis of DM was based on a fasting plasma glucose (FPG) of greater than 7.0mmol/Fasting was defined as no caloric intake for at least 8 hours and a prior clinical diagnosis. I classified smokers as having a history of smoking and no smoking, while alcohol was categorized as current alcohol consumption and no alcohol consumption. The hospital is located in the South Eastern region of Uganda in Jinja. The hospital is located in the South Eastern region of Uganda in Jinja Central Division, Jinja Municipal Council near the source of the Nile. The hospital was founded in 1962 and has a bed capacity of 600. The hospital serves several patients across the region some of who are referred from other hospitals and health center IVs while others are self-referred. Among the services provided include Eye services, medical, surgical, orthopedic, private wing, gynecology, pediatric, dental, ENT, lab, X-ray, scan, immunization, HIV testing, counseling, reproductive health services, and safe male circumcision. The hospital has 15 wards which include; surgical female/male, medical male/female, TB, Eye, Urological, Grade A, An annex, psychiatric and children's wards, an intensive care unit, postnatal, and maternity wards.

The clinic for patients having diabetes is located in Out Patient Department. The diabetic clinic receives on average 100 patients every Thursday of the week and which gives approximately 400 patients monthly. The patients who come to attend this clinic mainly reside in the areas neighboring Jinja towns like Bugembe, Wanyange, Njeru, and Mafubira, and within the Municipality. The people in the Jinja area feed on staple foods like sweet potatoes, cassava, yams, and matooke. The main economic activities carried out by the people include subsistence farming, sugar cane planting, bricklaying, and fishing especially those staying near the lake shores.

2.3. ***Study Population***

The study was carried out among patients with diabetes with complete records at Jinja Regional Referral Hospital from 2019 to 2022.

2.4. ***Sample size determination***

The researcher used the Kish Lesley (1965) formula for sample size determination, the researcher will use 27% to estimate the sample size based on the study that was carried out to establish the prevalence of diabetic peripheral neuropathy in Africa and they obtained a prevalence of 2%. (Shiferaw WS et al, 2020)

n=Z2pq/E2

Where n=sample size,

Z score for 95% confidence level is 1.96,

p=0.02,

q=1-0.02

The margin of error E==0.03

Therefore n=1.96*1.96*0.02*0.98/0.0009

=1000

Sampling technique

A systematic sampling technique was used during the study. The researcher selected members of the population from the records.

Sampling procedure

A systematic sampling procedure was used to pick 1000 respondents. The researcher organized the sample into stages where a unit of analysis was systematically grouped until each unit was selected. This was because everyone in the target group had an equal chance of being included in the study.

2.5. ***Eligibility of the study***

Inclusion criteria

Patients having diabetes at Jinja Regional Referral hospital were included in the study.

Exclusion criteria

The study excluded patients who had diabetes but with incomplete records and was not fully registered with the registrar.

Definition of variables

Independent variables

They were socio-demographic factors like age and sex.

Dependent variables

· Patients with a diagnosis of diabetes nephropathy at JRRH.

Research instruments

The researcher designed a data abstraction tool under supervision addressing the research questions of the study. This was used to systematically obtain data from the records.

2.6. Data Collection Procedure

The researcher was given a letter from Heath Tutors College which was taken to the hospital administration of JRRH. Upon approval, the Principal investigator was introduced to the clinic for people with diabetes and was given access to the patient's files. Data were collected from the patient's register from May 2019 to June 2022.

Data quality control

It was done through pre-visiting, training of research assistants, and pretesting of data abstraction tools.

Storage

Data was stored on a computer and a flash disc.

Pre-testing

The study tool was tested on data from records at the diabetic clinic from JRRH and necessary adjustments were made to ensure validity and reliability. The researcher outlined his objectives, developed a test guide, conducted a pretest, analyzed data, interpreted it then summarized the findings. Its main purpose was to identify problems during data collection.

Pre visiting

During pre-visiting, the researcher went to the clinic for patients having diabetes to check how the health workers record and receive the patients.

2.7. Data Management

The data was edited by the researcher after checking for completeness of the data abstraction tool and it was kept safely under lock and key in a cabin to avoid manipulation by any third party other than the researcher. Coding was done by the researcher.

Data Analysis

After collecting the data, it was organized and analyzed using a statistical package for social sciences (SPSS) version 18.0 and Micro Soft Excel, and findings were presented using descriptive statistics in form of tables, figures, and cumulative frequency.

2.8. Ethical Consideration

The proposal was presented to the Health Tutors College Research Committee and once permission was granted, the committee provided an introductory letter which was presented to the director of JRRH to seek permission to do the study. A waiver of consent was sought from the institutional review board of JRRH since the study was from the patient's records. Confidentiality was highly accorded by the researcher and anonymous.

3. FINDINGS

In this study, the number of females was 675 (67.5%) and the number of males was 325(32.5%). The number of patients who were smoking was 52(5.2%) and 208(20.8%) were taking alcohol.

The number of patients who engaged in adequate physical activities was 593(59.3%). The number of patients with high cholesterol levels was 224(22.4%). The number of patients who were HIV positive was 169(16.9%). The patients who had eye problems were 90(9.0%). The number of patients with kidney problems was 156(15.6%) and heart or brain problems were 628(62.8%). The number of patients with footing problems was 540(54.0%). The number of patients with DPN was 540(54%).

In this study, the mean age was 51.1 years which was statistically significant for the development of diabetic peripheral neuropathy (X2= 4.130, P= 0.389).

Alcohol intake increased the high risk of developing diabetic peripheral neuropathy (X2= 35.224, P= 0.001) compared to patients who do not take alcohol.

Patients with high cholesterol levels were at risk of developing DPN. (X2=19.153, P=0.001)

Patients with kidney and heart or brain problems were at an equal chance of developing diabetic peripheral neuropathy (X2=22.97, P=0.0010)

Patients with a positive HIV status had the least chance of developing DPN (X2=1.936, P=0.7480).

Table 1: Demographic and clinical characteristics of patients with diabetic neuropathy

Variable		**Mean (±s.d)**	**+/-SD**
Age		51.1	13.09
BMI		27	9
		Frequency	Percentage frequency
Sex	Female	675	67.5
	Male	325	32.5
Smoking	Yes	52	5.2
	No	865	86.5
	Quit	83	8.3
Alcohol	Yes	208	20.8
	No	644	64.4
	Quit	150	15.0
Adequate physical activity	Yes	593	59.3
	No	410	41.0
Cholesterol levels	Yes	224	22.4
	No	775	77.5
HIV Status	Positive	169	16.9
	Negative	831	83.1
Eye problems	Yes	90	9.0
	No	910	91.0
Kidney problems	Yes	156	15.6
	No	844	84.4
Heart or brain problems	Yes	628	62.8
	No	375	37.5
Footing problems	Yes	110	11.0
	No	887	88.7
Peripheral neuropathy	Yes	540	54.0
	No	460	46.0

In this study, the prevalence of diabetic peripheral neuropathy among diabetes patients was 540(54%).

In this study, the number of patients who take alcohol and developed DPN was 145(14.5%) while the number of patients who do not take alcohol but developed DPN was 304(30.4%), and those who quit but developed DPN was 89(8.9%).

In this study, the number of males who developed DPN was 180(33.0%) while 340(67%) females developed DPN.

In this study, the number of patients who had cholesterol levels and developed DPN was 139(25.7%) while those who had no cholesterol levels but developed DPN were 398(74.3%).

In this study, the number of patients who had eye problems and developed DPN were 61(11.3%) while those who did not have eye problems but developed DPN were 470(89.7%).

In this study, the numbers of patients who had kidney problems and developed DPN was 109(20.1%) while those who did not have kidney problems but developed DPN were 428(79.9%).

In this study, the number of patients who had heart or brain problems and developed DPN was 319(59%) while the number of patients who had no brain or heart problems but developed DPN was 219(41%).

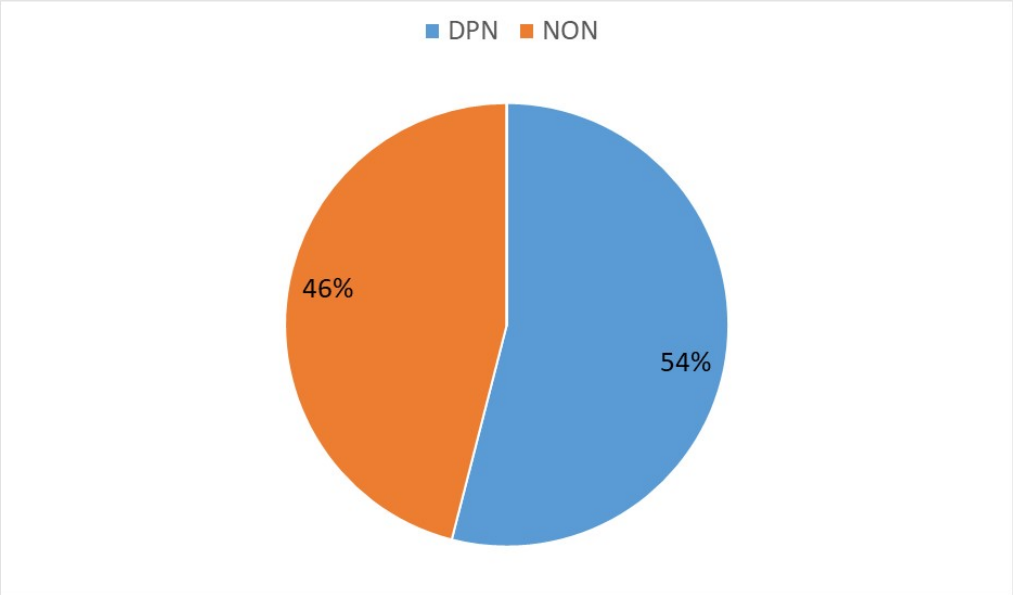

Figure 1: Prevalence of diabetic peripheral neuropathy among diabetes patients.

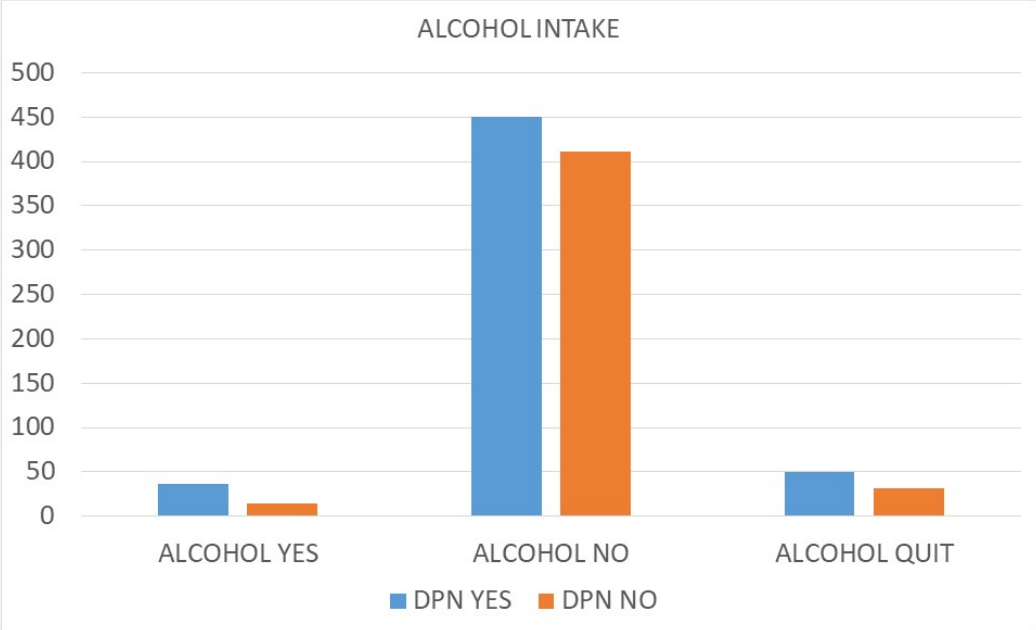

Figure 2: Comparison of alcohol intake with DPN

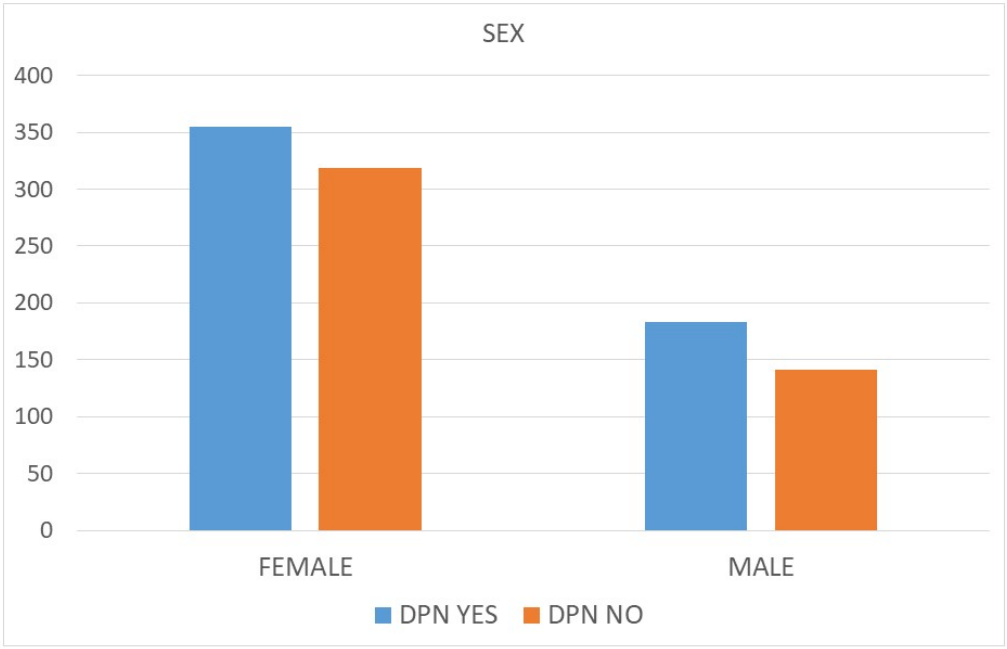

Figure 3: Comparison of sex with DPN

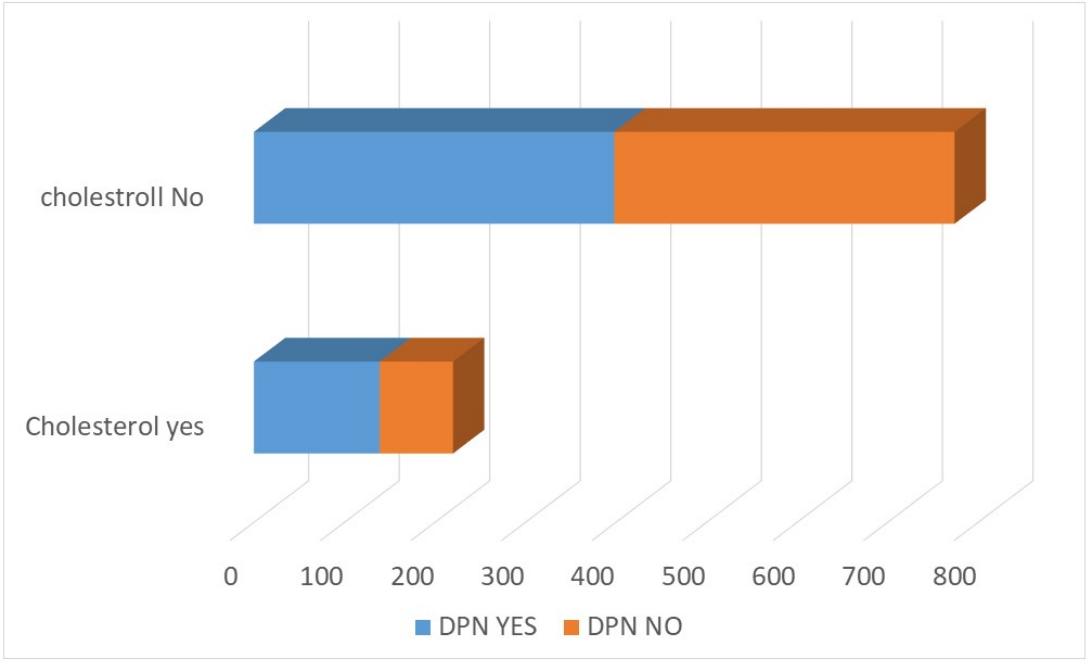

Figure 4: Comparison of cholesterol levels with DPN.

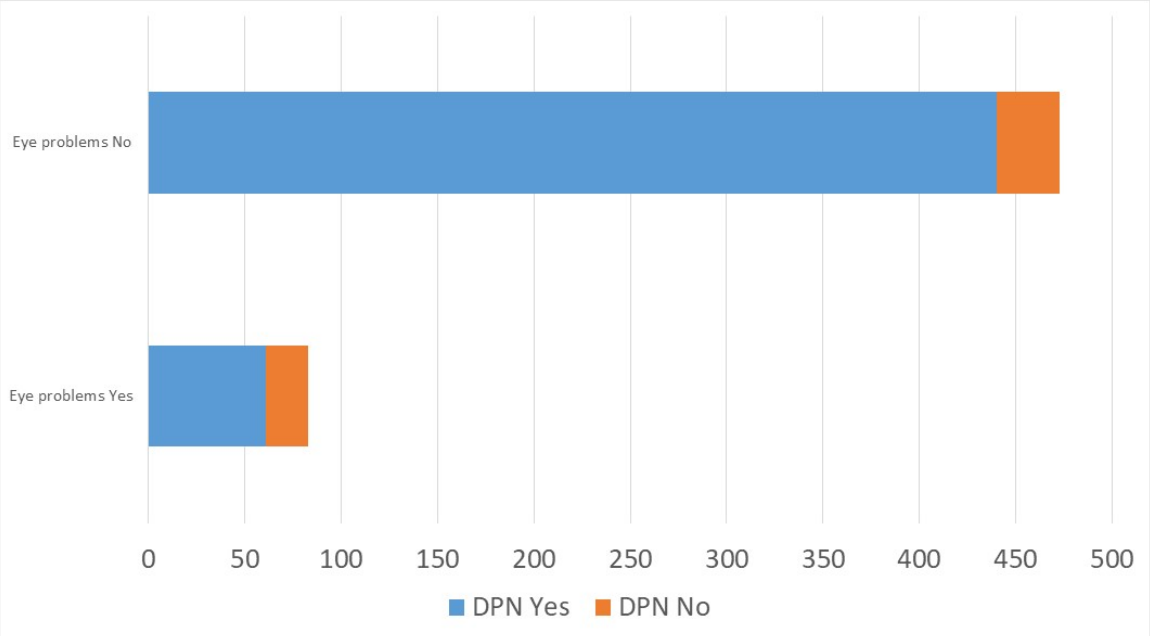

Figure 5: Comparison of eye problems with DPN

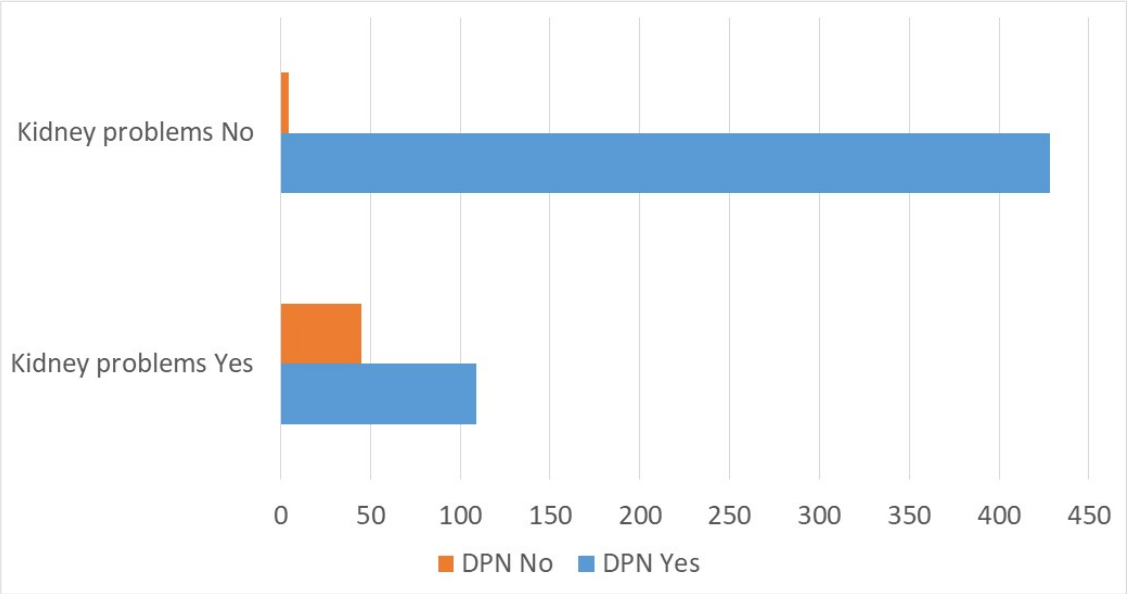

Figure 6: Comparison of kidney problems with DPN.

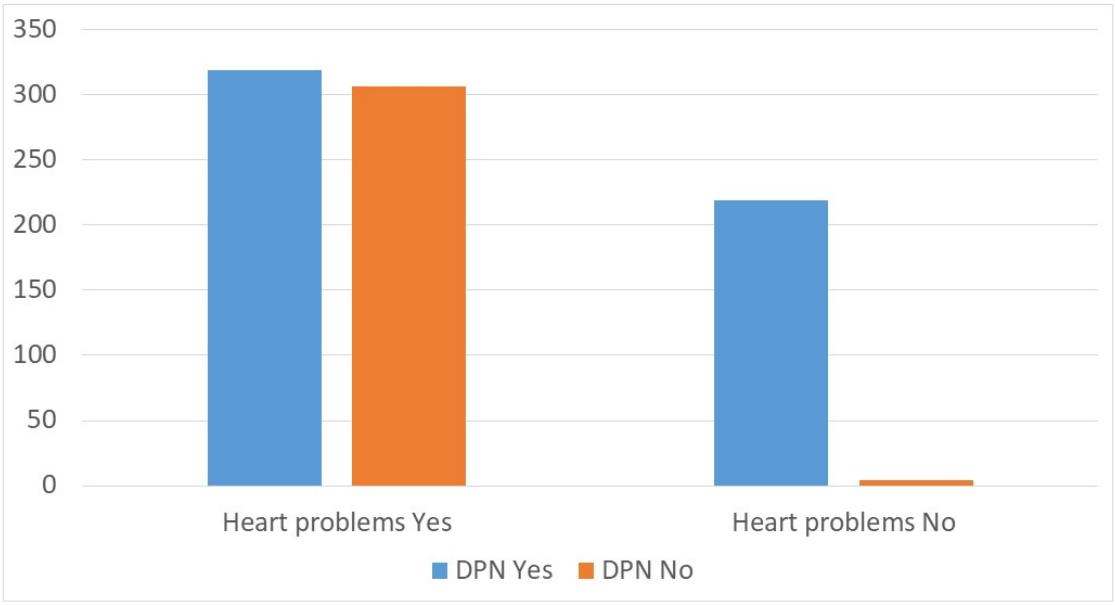

Figure 7: Comparison of heart or brain problems with diabetic peripheral neuropathy.

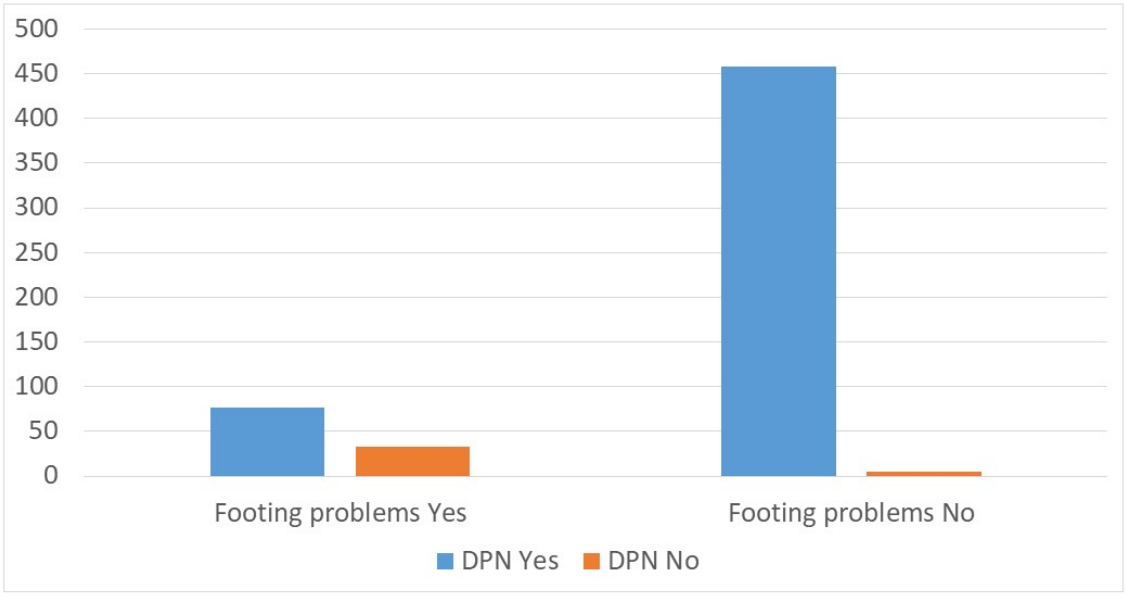

Figure 8: Comparison of footing problems with diabetic peripheral neuropathy

Table 2: Factors associated with diabetic peripheral neuropathy among patients with diabetes.

VARIABLE		**PERIPHERAL NEUROPATHY YES (N=540)** MEAN (+/- SD)	**PERIPHERAL NEUROPATHY NO(N=460)** Mean (+/- SD)	**Chi-square**	**P-value**
AGE		51.1	13.09	102.033	0.991
BMI		23.1	7.0	95.00	0.004
Sex	Female	355	319	4.130	0.389
	Male	183	141		
Smoking	Yes	37	15	10.048	0.123
	No	450	411		
	Quit	50	32		
Alcohol	Yes	145	62	35.224	0.001
	No	304	336		
	Quit	89	61		
Adequate physical activity	Yes	325	266	1.349	0.001
	No	214	193		
Cholesterol	Yes	139	81	19.153	0.001
	No	398	376		
HIV status	positive	98	70	1.936	0.748
	Negative	440	387		
Eye problems	Yes	61	22	20.934	0.001
	No	470	433		
Kidney problems	Yes	109	45	22.97	0.001
	No	428	413		
Heart or brain problems	Yes	319	306	22.97	0.001
	No	219	154		
Footing problems	Yes	76	33	14.304	0.006
	No	458	425		

In this study, the number of patients who had footing problems and developed DPN was 76(16.2%) compared to those who had no footing problems but developed DPN and were 458(84.8%).

4. DISCUSSIONS:

DPN is a very distressing chronic complication of diabetes with an array of poor outcomes for example DPN leads to neuropathic pain and diminished sensation which in turn can lead to frequent falls and injuries, restriction in movement, and poor quality of life.

4.1. ***To establish the prevalence of diabetic neuropathy among diabetic patients***

The prevalence of diabetic neuropathy was 54% among patients with diabetes of JRRH. The study showed that there is an increasing trend of cumulative DPN prevalence over time from May 2019 to June 2022 and it's believed to be more likely associated with poor glycemic control as patients receive care at JRRH. Uncontrolled hyperglycemia

leads to the activation of different mechanisms such as the polyol pathway, generation of advanced glycation end products and reactive oxygen species, and activation of the protein kinase pathway which plays a big role in the pathogenesis of DPN. This result is inconsistent with findings in a cross-sectional study done at Mulago by Kiseka *et al*, (2019) where the overall prevalence of DPN was 29.4 %. This is attributed to poor glycemic control mechanisms due to poor access to the services. The health workers should have flexible clinic days to accommodate all clients who need the services.

4.2. ***To determine the factors associated with diabetic neuropathy among diabetic patients.***

Patients over 51 years of age were found more likely to develop DPN compared to those below the age of 51 years which is consistent with a cross-sectional study that found that the elderly are more at risk of developing DPN in Saudi Arabia Amour *et at,* (2019).

Patients with heart problems were more predisposed to DPN unlike those who didn't suffer from heart problems which are similar to a study done in northern Tanzania by William *et al,* (2019) that showed heart problems or hypertension increases the risk of developing DPN. This is because high blood pressure from diabetes can damage blood vessels and the nerves that control the heart and blood vessels. The health workers should therefore manage the risk factors.

Patients who had high cholesterol levels were at a high risk of developing DPN much earlier than those who had low cholesterol levels. This is due to severe hypoglycaemia episodes among patients with type 1 diabetes and elevated triglycerides, low physical activity, and limited range of motion among patients with type 2 diabetes which is similar to a cross-section study done in Tanzania by William *et al,* (2019).

Patients who had a high body mass index BMI were at a higher risk of developing DPN than those who had a BMI of less than 25. This is because fat causes neuropathy and inflammatory cascades resulting from visceral fat. Previous studies have also shown consistent associations of obesity with DPN and obesity is harder to treat due to diet which is similar to a case study done in northern Tanzania William *et al,* (2019). This can be improved by continuous monitoring of body weight.

Patients with Kidney problems were at a high risk of developing DPN because kidney failure causes a lot of neurological disorders affecting the central nervous system and the peripheral nervous system. This is due to poorly controlled sugars which cause damage to blood vessel clusters of the kidneys that filter waste from the blood. This is also similar to a case study done at Kilimanjaro hospital in Tanzania by Amour et al, (2019). This can be controlled by health workers continuously monitoring the blood sugars of patients with diabetes.

Patients with Eye problems were at a high risk of developing DPN similar to a case study done in northern Tanzania Amour *et al, (*2019). These patients have excessive vascular leakage of fluids, proteins, or lipids in the macular area which leads to the development of DPN. This is due to delayed diabetic controls. This can be solved by optimizing blood sugar control together with tightly controlled blood pressure by health workers.

Patients who did not engage in adequate physical activity were also at high risk of developing DPN similar to a cross-sectional study done by Smith J et al. The presence of DPN is strongly associated with decreased activity levels as measured by steps per day. Health workers should encourage patients to practice adequate physical exercises to decrease pain and neuropathic symptoms as exercises also improve glycemic control and minimize diabetic complications. Regardless of the type of exercise chosen by the patient, a slow progressive weight-bearing program allows proper time to assess the tissue response of the patient to exercises to ensure that the exercise is safe.

Smoking also increases the risk of developing DPN because it causes vasoconstriction which increases the risk of developing DPN. Smoking also worsens neuropathy by inducing insulin resistance and higher insulin needs. Smoking may also have

a direct toxic effect and may induce DPN via hypoxemia and microvascular insufficiency. Smokers also have poorer adherence to recommended self-care compared to nonsmokers and tend to accumulate risky behaviors. This is also similar to a study done by William et al. Health workers should encourage patients to avoid smoking.

Nonetheless, the following diseases were found to be associated with DPN; eye problems (X2= 20.934, P= 0.001), Kidney problems (X2= 22.97, P=0.001), Heart or brain problems (X2=7.276, P=0.122).

5. Conclusions

The Prevalence of DPN is high (54%) in Jinja Regional Referral Hospital among patients with diabetes.

The factors associated with diabetic neuropathy among diabetic patients are; Age, BMI, Adequate physical activity, eye problems, kidney problems, heart problems, footing problems, and smoking.

6. Limitations

• . The nature of the study design retrospective limited the accurate assessment of the association between DPN and risk factors.

• The study period considered was after Covid-19 which made it difficult for patients to access care so the findings in this study might be affected by Covid-19.

• The study was done from the DM clinic however there could be other patients on other wards who might not have been registered. So we cannot generalize our findings to all patients with diabetes.

• Poor documentation of DPN diagnosis and supportive laboratories investigations reduced my ability to confirm the diagnosis of DPN.

7. Recommendations:

1. The researcher recommended that the Ministry of Health through health workers at all levels should continue to sensitize all people about the factors associated with diabetic neuropathy among diabetic patients.

2. Health policies should focus on early detection and prevention to reduce morbidity, impaired quality of life, and health care costs associated with DPN.

3. It is recommended that routine assessment, screening, and counseling for diabetic peripheral neuropathy among patients attending DM clinic be always done to enable timely identification of cases.

8. ACKNOWLEDGEMENT:

I would also like to extend my great thanks to the staff of Health Tutors College Mulago for the guidance and efforts in encouraging me throughout this programme.

Special thanks also go to my supervisor Mr. Katumba James Davis for his tireless efforts in reading through and making corrections to my work.

I wish to extend my sincere gratitude to Jinja Regional Referral Hospital for all the assistance accorded to me.

Last but not the least, I would like to thank my coursemates who assisted me in one way or the other.

9. ABBREVIATIONS AND ACRONYMS:

BMI : Basal metabolic index
CDC : Centers for Disease Control
CME : Continuous Medical Education
CPD : Continuous Professional Development
DM : Diabetic's mellitus
DPN : Diabetic peripheral neuropathy
HMIS : Health Information Management System
JRRH : Jinja Regional Referral Hospital
NGF : Nerve growth factor

OPERATIONAL DEFINITIONS

Complete records are the ones whose information was fully captured on the record sheet.

Diabetes Mellitus is a person with a record of high fasting blood sugar

Peripheral Neuropathy is a person with a record of numbness or nerve injury from the registrar.

10. Funding:

The source of funding for this study was me.

11. Conflict of interest:

There was no conflict of interest.

12. Publisher details:

Publisher: Student's Journal of Health Research (SJHR)
(ISSN 2709-9997) Online
Category: Non-Governmental & Non-profit Organization
Email: studentsjournal2020@gmail.com
WhatsApp: +256775434261
Location: Wisdom Centre, P.O.BOX. 148, Uganda, East Africa.

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