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Prevalence of Diabetic Peripheral Neuropathy among adults with Diabetes Mellitus attending Kampala International University Teaching Hospital

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ABSTRACT

Diabetic Peripheral Neuropathy (DPN) is the most common type of Neuropathy and the commonest complication of Diabetes Mellitus contributing to major cause of non-traumatic foot amputation which has impact in substantial morbidity and mortality. Early detection of DPN with good glycemic control may prevent foot amputations. Therefore, the aim of this study was to determine the Prevalence of Diabetic Peripheral Neuropathy among adults with Diabetes Mellitus attending Kampala International University Teaching Hospital**.** A cross-sectional study which recruited 319 known DM patients was conducted in Internal Medicine Department and Diabetic Clinic at KIU-TH from December 2019 to March 2020 and from October to December 2020. Questionnaires were used to obtain clinical and sociodemographic data**,** neurological exam was done to assess the DPN and blood sample was collected from each participant for the determination of glycemic control (Glycosylated Hemoglobin). Data was analyzed using STATA version 15.0 while bivariate and multivariate logistic regression analyses were done to compare each independent variable with DPN (p-value*< 0.05).* The mean age of study participants was 59.4±13.6 years and females were 197(61.8%). The prevalence of DPN was at 65.8% (95%, CI 60.4-70.9). The prevalence of DPN among DM patients attending KIU-TH was high. In conclusion, the prevalence of DPN among DM patients attending KIU-TH was high. Clinicians should start doing a peripheral neurological exam in all DM patients and awareness of health personnel about factors associatedwithDPN.

Keywords: Prevalence, Diabetes, Peripheral and Neuropathy.

INTRODUCTION

Diabetic peripheral neuropathy is a form of nerve damage that typically affects the feet and legs and sometimes affects the hands and arms in diabetic patients. It is the commonest form of neuropathy among Diabetics and should be diagnosed after the exclusion of other causes of polyneuropathy. The most common form is distal symmetric sensorimotor polyneuropathy [1]. The first recognition of Diabetes Mellitus was documented in the Egyptian ancient papyrus, discovered by Georg Ebers in 1862, dating back to 1550 BC which highlighted the first documented cases of DM over 3500 years ago as stated by Ebbell, in 1937 and Tattersall in 2010 [2]. Celsus had defined DM as an ailment which presented with excessive urination in frequency and volume, and painless emaciations. Physicians started studying diabetes and its complications in 18th century. The works of the 19th century (de Calvi, Pavy) established the link between diabetes mellitus and diabetic peripheral neuropathy [3]. Ancient texts describing what is believed to be diabetes mellitus represent clinical records of polyuric states in association with increased thirst, muscle wasting and premature death. In these early texts, neuropathic features of the clinical picture of diabetes can be found extremely rarely [2].

Aim of the study

To determine the Prevalence of Diabetic Peripheral Neuropathy among adults with Diabetes Mellitus attending Kampala

International University Teaching Hospital.

Prevalence of diabetic peripheral polyneuropathy

DPN is one of the most common complications of DM, affecting nearly half of diabetics; it is often asymptomatic [1]. Epidemiological studies suggested that DPN is the most prevalent pain condition with neuropathic presentation. This may be so painful that it prevents patients from performing their daily activities, thereby impacting their employment and social life [4]. [5] conducted a cross-sectional study to determine the prevalence of DPN by using a questionnaire among 32-85 years diabetic patients in Morocco and found that the prevalence of DPN varies from 5-100%; it reflects different diagnostic criteria used and diverse study populations. The same study revealed a prevalence of painful diabetic neuropathy varying between 10% and 60% showed that DPN has an impact on quality of life and its prevalence is increasing, but remains largely under-diagnosed and under-treated. [4] carried out a meta-analysis study using a questionnaire assessing the prevalence of DPN among adults DM patients in United Kingdom, United States of America, in Belgium, in France and in South Africa and from the MENA (Middle East and North Africa: Saudia Arabia, Turkey, Algeria, Egypt, Lebanon, Jordan, Gulf States) and the results showed that the prevalence of DPN was 43.2% (7898 participants, 5 studies, 7 countries and 8 surveys) and in United Kingdom, the prevalence of DPN was 22%–35%, 11%–25% the United States of America, 14% in Belgium, 20% in France and 30% in South Africa and from the MENA. [6] conducted a cross-sectional study to determine the prevalence of sensory peripheral neuropathy in Kurnool (India) among adults diabetic patients aged 30 years and above which revealed that Diabetic Peripheral Neuropathy is the third most common neurological disorder and it ranges about 54% among 1,000,000 people per year and the prevalence rate of neuropathy ranges from 8.54% in type 1 and 13.46%in type 2 diabetic patients. [7] in a cross-sectional study to determine the proportion and the determinants of DPN in Douala (Cameroon) among 18 years and above 306 DM patients, found a prevalence of 33.3% and DPN was symptomatic in 79/102 (77.4%) patients. The study was done among T1DM and T2DM by looking at DPN and its determinants; one of the determinants of DPN was urban residence. [8] carried out a cross-sectional study to find out the prevalence of DPN and its associated factors by using the Michigan Neuropathy screening tool in Ethiopia among 18 years and above diabetic patients which revealed that the overall prevalence of diabetic peripheral sensory Neuropathy was 52.2% and among this, 51.2% had T1DM. [9] conducted a cross-sectional study to compare different methods used for the diagnosis of DPN in a sub-Saharan population, and to evaluate the Nerve Conduction Study as a potential tool for detection of DPN in a low resource in Zanzibar (Tanzania) among 100 Adult DM patients and they found a prevalence of 45 %. In the above studies, prevalence of diabetic peripheral neuropathy were variable based on different types of diabetes, disease duration, existing healthcare facilities, sample selection, different diagnostic criteria used, and variable methods used in physical examination. Most of these studies were conducted in urban areas. Our study was conducted in rural settings. However, the above literature raises contextual and methodological gaps. Contextually, these studies were done in hospitals with high standard of facilities by using the required tools for assessment of diabetic peripheral neuropathy. Methodologically, some of these studies followed DM patients for short duration by using only one criteria for classification of neuropathy: neuropathic pain questionnaire. That is why our study tried to fill these gaps in the context of Ishaka (rural area).

Pathophysiology, diagnosis and management of diabetic peripheral neuropathy

The pathogenesis of DPN is complex and marked by both metabolic and vascular

factors. The principal key known to cause metabolic derangement is prolonged hyperglycemia that causes axonal and microvascular injury. Other factors have been involved in the pathological mechanism of DPN such as hyperglycemia, toxic adiposity, oxidative stress, mitochondrial dysfunction, activation of the polyol pathway, accumulation of advanced glycation end products (AGEs) and increase of inflammatory markers [10]. Although nerve fiber loss is accepted as the genesis of insensitivity in DPN, the pathophysiological explanation behind neuropathic pain in diabetes is poorly understood. Sural nerve biopsies from patients with DPN revealed microvascular defects, including endoneurial basement membrane thickening as well as endothelial cell proliferation and hypertrophy, findings which were absent in diabetics without DPN. Endothelial nitricoxide (NO), in turn, a powerful vasodilator, becomes less available because it is used in the formation of peroxynitrite, a strong oxidant, and toxic to endothelial cells. Another possible pathophysiological way in DPN involves the activation of the nuclear enzyme, poly (ADP ribose) polymerase (PARP) that like oxidative stress can lead to cell energy deficit. The state of insulin deficiency associated to DM also favors the development of DPN, since insulin possesses neurotrophic effects that influence the growth and survival of neurons [11]. The diagnosis of DPN should be based on a careful anamnesis (history) and neurological examination, focused on the detection of specific organs or affected peripheral nerves by the disease itself. Neurological assessment should be performed bilaterally to determine the sensitivity, reflexes, and muscular strength. The 10 g Semmes-Weinstein monofilament (SWM) is recommended in the evaluation of the tactile sensitivity (protopathic), which allows assessing the risk of ulceration. This test has a low cost, it is easy to apply, and has a high sensitivity. However, a normal SWM test does not rule out other forms of DPN. The vibration sensitivity can be qualitatively tested with a 128 Hz tuning fork. There have been also some validated scores used for clinical symptoms and signs such as Douleur Neuropathique en 4(DN4), Diabetic Neuropathy Symptoms (DNS), Neuropathy Disability Score (NDS), Michigan Neuropathy Screening Instrument (MNSI), Toronto Clinical Neuropathy Score (TCNS)...and other investigations more accurate like quantitative sensory testing, sudomotor function, neurophysiologic studies, skin punch biopsy and Corneal Confocal Microscopy [12]. According to a study done by Petropoulos et al. in 2018 in Qatar, the Corneal Confocal Microscopy (CCM) has emerged as a powerful diagnostic tool for the detection of small fiber neuropathy, the earliest manifestation of DPN, and has shown prognostic utility in identifying those who develop clinical DPN as well as showing remarkable consistency demonstrating early nerve regeneration in a number of clinical trials. Despite the use of CCM in DPN, multiple studies suggest that CCM could also be useful in characterizing the extent of axonal injury in many other peripheral neuropathies and central neurodegenerative disorders.

For an effective therapeutic approach, general measures, such as proper metabolic control and lifestyle changes, should first be considered. Assuring a good glycemic control is critical for the management of patients with DPN.

Patients with feet sensitivity issues should be instructed to take special care. The following recommendations should be put in place: use of comfortable shoes (orthotic sandals); use of white cotton socks and seamless (which should be changed daily); nail cutting care; proper drying, inspection of the feet and application of urea-based creams .Nevertheless, available drugs have limited efficacy and the combination of more than one class of drugs is always important for the achievement of the therapeutic goal. The treatment is considered significant if pain reduction, evaluated by analogical or numerical scales is superior to 50% [12]. First-line

drugs are tricyclic antidepressants (Amitriptyline, Imipramine), calcium channel anticonvulsants modulators, alpha-2-delta subunit binders (gabapentin and pregabalin), and selective serotonin and noradrenalin reuptake inhibitors (Duloxetine).When the expected analgesia is not achieved, association of two drugs among these three medication classes can be made. Opioids are second-line drugs and are an alternative upon total or partial failure of the latter three medication classes. Topical agents (capsaicin) are indicated in the case of localized pain. The thioctic acid, also called alpha lipoic acid, stands out in pathogenesis-based treatments of DPN, being a powerful antioxidant that inhibits the formation of free radicals and acts as coenzyme in mitochondrial multienzyme complexes. When used intravenously, it contributes to a cellular oxidative stress reduction, nerve conduction improvement and a significant reduction of pain. The dose recommended is 600 mg daily in the morning under fasting conditions, showing good tolerability. It should be stressed that hypoglycemia may occur during the treatment. Benfotiamine also demonstrated the ability to improve neuropathic symptoms, by reducing accumulation of advanced glycation end products (AGEs) in tissues. Benfotiamine is a soluble precursor of thiamine (vitamin B1), which emerged as a drug to counteract oxidative stress, reducing AGEs in tissues and preventing vascular endothelial damage [11].Additional drugs that also showed improvements in the DPN symptoms, either in clinical practice or in laboratory studies, include: L-acetylcarnitine, which stimulates the neuronal growth factor enhancement and corrects electrophysiological deficits through modulation of its activity [12].

METHODOLOGY

Study site

The study was conducted at Kampala International University Teaching Hospital (KIU-TH) in the Department of Internal Medicine. The department has 5 specialists, 17 senior house officers, 2 medical officers, 5 interns and 10 nurses. The medical out-patient department has a general, medical and private clinic conducted on a daily basis; diabetic and hypertension clinic conducted once a week mainly on Wednesday. That specialized clinic is led by a family medicine specialist who reviews all the Diabetic and Hypertensive patients.

Study area

The study was conducted at KIU-TH. Kampala International University Teaching Hospital is located in Ishaka-Bushenyi municipality, western Uganda, a private non-profit hospital approximately 5 km away from Bushenyi district headquarters as well as Bushenyi Health Centre IV which is a government unit. The hospital is located in Ishaka town. Ishaka is a municipality in Bushenyi district and is found in Igara County, Bushenyi District, approximately 62 kilometers (39 miles) West of Mbarara district in western Uganda. The Internal Medicine department serves clients from the areas of Bushenyi, Sheema, Rubirizi, Mitooma and other neighboring districts in western Uganda.

Population

The study population included all patients who attended the Medical outpatient clinic, diabetic clinic, general and private Outpatients department at KIU-TH.

Target population

All known Diabetic patients in the catchment area of KIU Teaching Hospital.

Accessible population

All patients with DM who presented to medical outpatient department, Diabetic clinic, general and private outpatients department (KIU-TH) during the period of the study and who were aged 18 years and above.

Study population

All DM patients who presented in Internal Medicine department, Diabetic clinic, general and private outpatients department (KIU-TH) during the period of the study who were aged 18 years and above and accept to consent for the study.

Sample size determination

Sample size was calculated using [13].

$$N=\frac{Z^2\ p\ x\ q.}{d^2}$$

N=desired sample size for population greater 10,000.

Z ^{2}=standard normal deviation, assuming a 95% confidence interval Z= 1.96.

p=proportion in the population estimated to have DPN in Uganda (Mulago Hospital, Kampala) =29.4% [14]

q= (1-p) = (1-0.294) =0.706.

d=Degree of accuracy for 95% confidence interval (0.05).

$$N=\frac{(1.96)^2\times 0.294\times 0.706}{(0.05)^2}$$

$$N=\frac{0.7973778624}{0.0025}$$

N=319 patients.

Internal medicine department receives about 18 diabetic patients per week (Medical outpatient department, DM clinic, General outpatient department, Private outpatient department combined) and approximately 70 patients per month.

Sampling techniques

Participants were consecutively enrolled until the target number was attained. Study participants were selected as they come to the outpatient clinics and DM Clinic. Details for the protocol which was used are shown in the flow chart (figure 1)below:

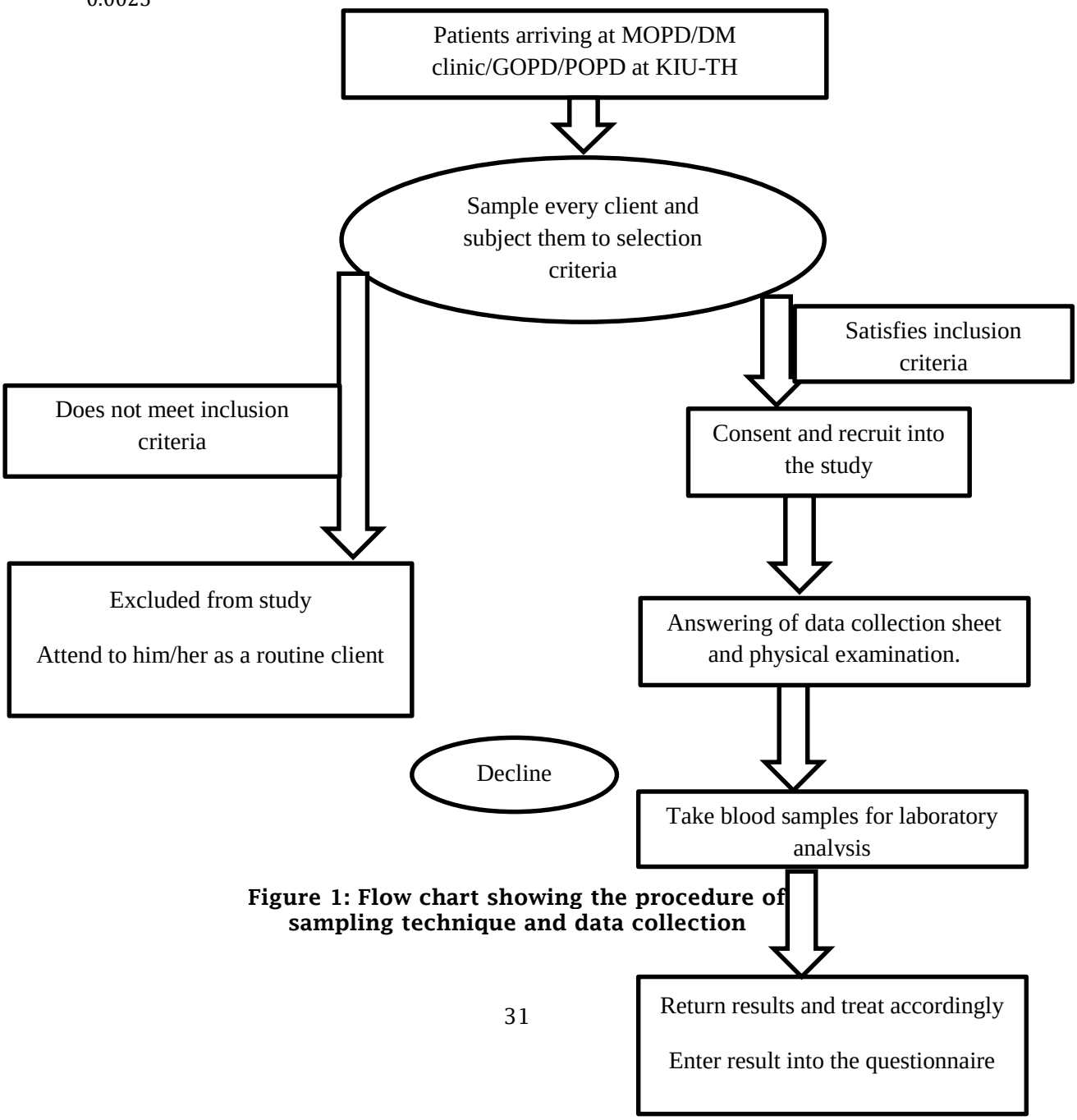

Figure 1: Flow chart showing the procedure of sampling technique and data collection

Eligibility criteria

Inclusion criteria

All adults (18 years and above) with DM who attended Internal Medicine department, DM clinic, General outpatient department and Private outpatient department during the duration of the study, and who provided a written consent to participate.

Exclusion criteria

A patient was excluded from participation in the study if he/she had any mental disorders or was unable to withstand an interview or he/she changed his/her consent during the study. We excluded also all pregnant women, newly diagnosed DM patients at the time of interview and very sick DM patients admitted in Medical ward.

Data collection method, tools and procedures

Data was collected using paper-based investigator-administered questionnaire that was designed in simple English and translated in Runyankole, based on the objectives and the conceptual framework. Patients were given information about the study, and then a written consent sought and signed. Demographics (age, sex, address, marital status, education status), history of chronic illness like hypertension, kidney disease, HIV, tuberculosis, social habits like use of alcohol and amount, smoking cigarette and number of sticks per day were taken, adherence to medication. We also asked about family history of DM, type of DM (from the history) and its duration, awareness of DM complications and DPN with its clinical presentation, practice of physical exercise and diet. Physical assessment of study participants included taking anthropometric measurements. These included: weight, height and Body Mass Index (BMI). The subjects' weight in kilograms was taken using a weighing scale manufactured by SECA®. Before the weight was taken, the subject took off his/her shoes and any heavy clothing. The weighing scale was calibrated every morning according to the manufacturer's manual, for those who cannot stand; a chair weighing scale was used. The height was recorded to the nearest 0.1 centimeter. The subject's height was measured using a SECA® wall mount station meter and a tape measure for those who could not stand. The height was recorded as the maximum distance from the floor to the highest point on the head. The BMI was calculated from a ratio of the patients' weight in kilogram to the square value of the height in meters. Normal BMI was defined as a value in between 18.5 and 24.9, overweight from 25 to 29.9, obesity from 30 and above [15]. Blood pressure was taken by using manual Sphygmomanometer with appropriate cuff sizes for the patient arms. High blood pressure was defined as systolic blood pressure ≥ l40 mmHg or diastolic pressure ≥ 90 mmHg. Using a sterile disposable syringe and needle, four (4) milliliters (mls) of blood was withdrawn from the anterior cubital fossa of each subject after cleaning with a swab soaked in 70% alcohol. Four (4) milliliters was placed in an EDTA (Ethylen diamine acetic acid) purple container for testing random/fasting blood sugar and glycosylated hemoglobin (HbA1c).

Furthermore, RBS/FBS was screened using a Control D glucometer machine made in India (2018) by Haiden technology with their respective glucose sticks. HbA1c was screened by using an Ichroma II Machine (2017) and the appropriated reagents for HbA1c. Each study participant received a printed copy of their RBS/FBS, HbA1c. The physical/neurological examination was done. Pressure sensation was assessed using 10g monofilament (Semmes westein test) at 4 of the 10 standard sites of the sole of the feet (plantar base of the big toe, 2nd and 5th toes and at the heel), avoiding areas with callosity. Vibration sense was elicited using a 128 Hz turning fork at the hallux of the big toe and Achilles deep tendon reflex was tested by using standard patellar hammer, both tools made in 2015(China). The Neuropathy Disability Score (NDS) and Diabetic Neuropathy Symptom Score

(DNS) were used in assessing the grade/degree of DPN for each patient. The NDS system is made of neuropathy score range from 0 – 10 which could also be used to assess severity of peripheral neuropathy by considering four(4) parameters: vibration sense by using a 128 Hz tuning fork(0=present,1=reduced/absent for each foot),temperature sensation by using a cold tuning fork(0=present,1=reduced/absent for each foot),pin-prick sensation by a monofilamenttest(0=present,1=reduced/absent for each foot and Ankle reflex/Achilles Tendon reflex by using a patellar hammer(0=normal,1=present with reinforcement,2=absent per side). Absence of Neuropathy (normal) was considered when the score was from 0 up to 2. The severity of neuropathy disability was graded as follows: mild (scores: 3–5), moderate (scores: 6–8), and severe (scores: 9–10). The NDS was validated and found to be 65% sensitive and 91% specific for diagnosing diabetic neuropathy [16]. For Diabetic Neuropathy Symptom Score (DNS), it is a four-item tool validated symptom score, with high predictive value to screen for Peripheral Neuropathy in diabetes. Symptoms of unsteadiness in walking, neuropathic pain, paraesthesia, and numbness are elicited. The presence of one symptom is scored as 1 point; the maximum score is 4 points. A score of 1 or higher is defined as positive for Diabetic Peripheral Neuropathy.

Data collection instruments

We had a semi-structured questionnaire as a guide to conduct individual interviews. We used 10g monofilament test, patellar hammer, 128-Hz tuning fork/Hartman C 128 for the assessment of DPN as described above.

Validity of data collection instrument

We used the Content Validity Index. This involved having five participants who were not part of the sample population and give them the questionnaire. The inter-participant agreement was then measured. The agreement of more than 70% was measured that the items of the questionnaire gave us the required information about DPN among DM patients.

Reliability of data collection instrument

By using the Cronbach's coefficient alpha, a value of more than 0.8 was taken to indicate that items of the questionnaire were reproducible and consistent.

Data quality control

Questionnaires were printed and pretested at KIU Teaching Hospital to ensure reliability and validity**.** We ensured that questionnaires were filled correctly by allowing enough time for response and filling. We also explained unfamiliar technical terms to the participants consistently. Questionnaires were also translated to the local language for easy understanding. For data completeness, the questionnaires were checked just after filling before they were taken for data entry and analysis. The blood samples were analyzed under KIU biochemistry laboratory in the hospital. It is well equipped to carry out the chemistry tests like FBS, HbA1c (Appendix VIII). Internal quality control was done for all samples and two samples were selected randomly and sent to a different certified laboratory in Uganda for external quality control (Lancet Laboratory/Mbarara).

Data analysis plan and presentation

Data were captured in paper forms and entered into EPI INFO 7.2, Microsoft Excel version 2010 and exported into STATA 15.0 for analysis. Data were analyzed according to the specific objectives. It was processed accordingly and summarized using means for continuous variables or proportions for categorical variable.

Ethical considerations

Informed consent and respect for participants. Voluntary recruitment was done and an informed consent was signed. Informed consent from participants was obtained after fully explaining the details of the study to them in English and Runyakole (appendix III). Participants were not forced to enroll themselves and were free to withdraw from the study at any time they wished without coercion or compromising of care that they were entitled to.

Risks and adverse events to study participants

Study participants underwent mild pain during pricking. There was also a potential risk to introduce infection during the process of draining blood from participants. However, the process of obtaining a blood sample was done gently and professionally by a phlebotomist to minimize risk of pain and minimize infection as far as possible. Additionally, 10g monofilament test, tuning fork and patellar hammer were used for neurological assessment according to standard local and international guidelines. No complications were expected during the study, there was no need for reimbursement for any damages.

Benefits of the research

The benefits of doing a full peripheral neurological exam and measuring the HbA1c among DM patients led to early diagnosis and medical treatment, which reversed foot amputation as outcome of DPN. The community benefited from laboratory tests at no cost of the patient.

Privacy and confidentiality

Identification of participants was by means of numerical codes. Details of respondents were kept under lock and key for privacy and confidentiality purposes throughout the course of research. Respect of the respondents' rights and fair treatment were strictly adhered to, thus minimizing harm and discomfort to them. There was no disclosure of participants' information to the public without their consent and all identities were removed from the results.

Selection of participants

All participants were given equal opportunity to participate in the study. Priority was not given in terms of tribe, interest group, race or religion. Systematic random sampling method was used to select participants and ensure equal chance of being selected for the study. Eligibility criteria were strictly adhered to.

Incentives and reimbursement

No monetary or any other form of incentives was offered to the participants but compensation and reimbursement was offered where applicable.

Approval procedure

Approval to carry out the study was sought from the department of Internal Medicine, the Faculty of Clinical Medicine and Dentistry and Directorate of post-graduate studies and finally the Research Ethics Committee of Kampala International University. All ethical documents were presented to the administration of Kampala International University Teaching Hospital before the study to be conducted and administrative clearance was obtained before commencement of the study.

Respect for community

The procedures involved in this study were not against the local community beliefs, traditions and culture. The findings from the study were communicated to the head of internal medicine department of Kampala International University Teaching Hospital as a formal feedback as well as office of District Health Officer, Bushenyi district so that the community can benefit from it.

Limitations

Poor cooperation or withdrawal of consent from some participants during the study.

Solution: Comprehensive counselling of participants with regards to the participation.

Lack of some other specific but unavailable investigations, such us electrophysiological tests, for assessing diabetic peripheral neuropathy.

Solution: Use of monofilament test, other tools and standard scores for neuropathy in order to overcome that limitation.

Dissemination of results

Findings of our research was presented to the internal medicine department, to all health workers of KIU-T.H (Nurses, Doctors) for assessment of DPN in clinics, during CME. We will use a station radio (Crane FM) or in DM clinic for the awareness of the local population and for our Diabetic clients. The bound copy will be submitted to University library, postgraduate and faculty offices. We hope to submit these findings for publication in peer reviewed international journals.

RESULTS

Study participants profile

Overall, 338 participants arrived at MOPD, DM clinic, GOPD and POPD at KIU-TH, 5 participants were excluded from the study because 3 were newly diagnosed DM and 2 were very sick. The participants who met the inclusion criteria were 333 and among them, 5 declined to consent and 9 declined the examination and the blood sample collection, finally 319 study participants consented and filled the study questionnaire, were examined and their blood sample taken during the study period and analyzed.

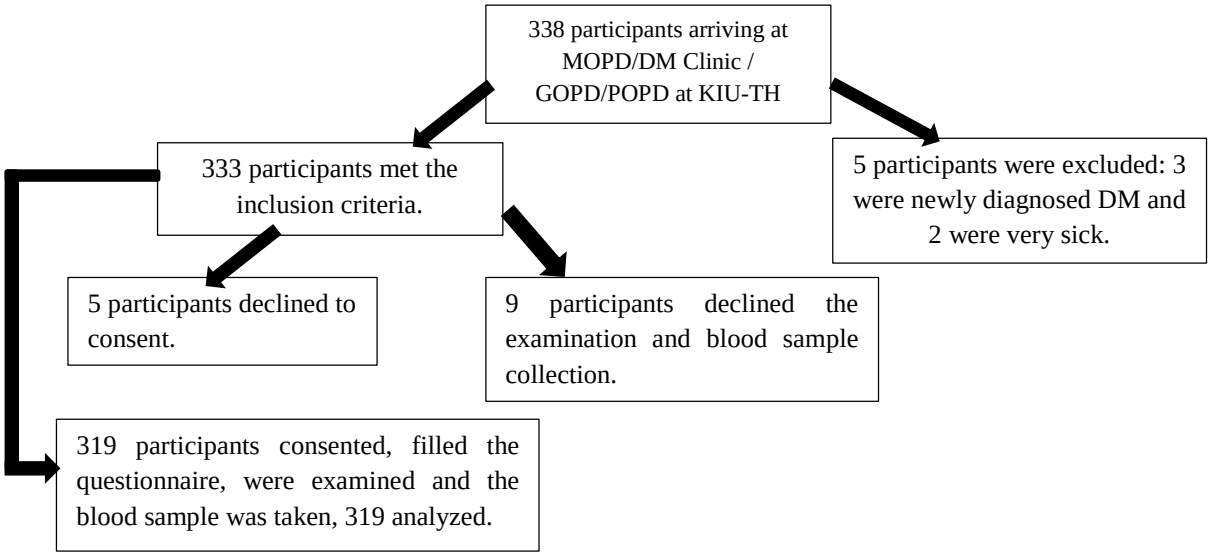

Figure 2. Study participants profile

Baseline characteristics of study participants of adults with Diabetes Mellitus attending Kampala International University Teaching Hospital.

Table 1. Baseline characteristics of the study participants

Baseline Characteristics	N=319
Sociodemographic characteristics	
Age, mean (±SD)	59.4 (±14.6)
Female, n (%)	197 (61.8)
Rural residence, n (%)	272 (85.3)
Married, n (%)	267 (83.7)
Education level, n (%)	
Primary	129 (40.4)
Secondary	35 (10)
None	137 (42.9)
Occupation, n (%)	
Peasants	248 (77.7)
Private business	22 (6.9)
Professional	22 (6.9)
Behavioral factors, n (%)	

Alcohol (Audit Score), n (%)	
Audit 1	35 (10)
Audit 2	31 (9.7)
Smoking	43 (13.5)
Medical factors, n (%)	
DM duration, mean (±SD)	7.33 (±6.40)
< 10 years	209 (65.5)
≥ 10 years	110 (34.5)
Types of Diabetes Mellitus, n (%)	
Type 1 DM	15 (4.7)
Type 2 DM	304 (95.3)
Diabetic therapy, n (%)	
Oral hypoglycemic agents	203 (63.6)
Insulin	41 (12.9)
Both Oral hypoglycemic agents + insulin	57 (17.9)
Not on diabetic therapy	3 (5.6)
BMI, mean (±SD)	26.26 (±3.48)
BMI Categories (Kg/m^2), n (%)	
Normal (18.5 - 24.9)	103 (32.3)
Overweight (25.0 - 29.9)	178 (55.8)
Obese (≥30)	38 (11.9)
HbA1c percent, mean (±SD)	7.61 (±2.47)
HbA1c percent, n (%)	
Good glycemic control (<7.0)	147 (46.1)
Poor glycemic control (≥ 7.0)	172 (53.9)
Fasting glucose (mmol/l), mean (±SD)	10.35 (±5.16)
Systolic BP (mmHg), mean (±SD)	138.4 (±19.77)
Diastolic BP (mmHg), mean (±SD)	85.8 (±12.95)
Hypertension, n (%)	160 (50.2)
HIV, n (%)	29 (9.1)

In table 1, majority of the study participants were females (61.8%) and most of them were married (83.7%), residing in rural area (85.3%) with mean age of 59.4 ± 14.6 years and were peasants by occupation (77.7%). Also, most of them were T2DM (95.3%) on oral hypoglycemic agents (63.6%), overweight (55.8%) with mean BMI of 26.26 ±3.48 and poor glycemic control (53.9%) with DM duration of less than 10 years (65.5%),mean duration of 7.33 ±6.40 years. A few study participants were taking alcohol/Audit Score 1 (10%) with history of smoking (13.5%) and hypertension (50.2%).

Prevalence of Diabetic Peripheral Neuropathy among adults with Diabetes Mellitus attending Kampala International University Teaching Hospital

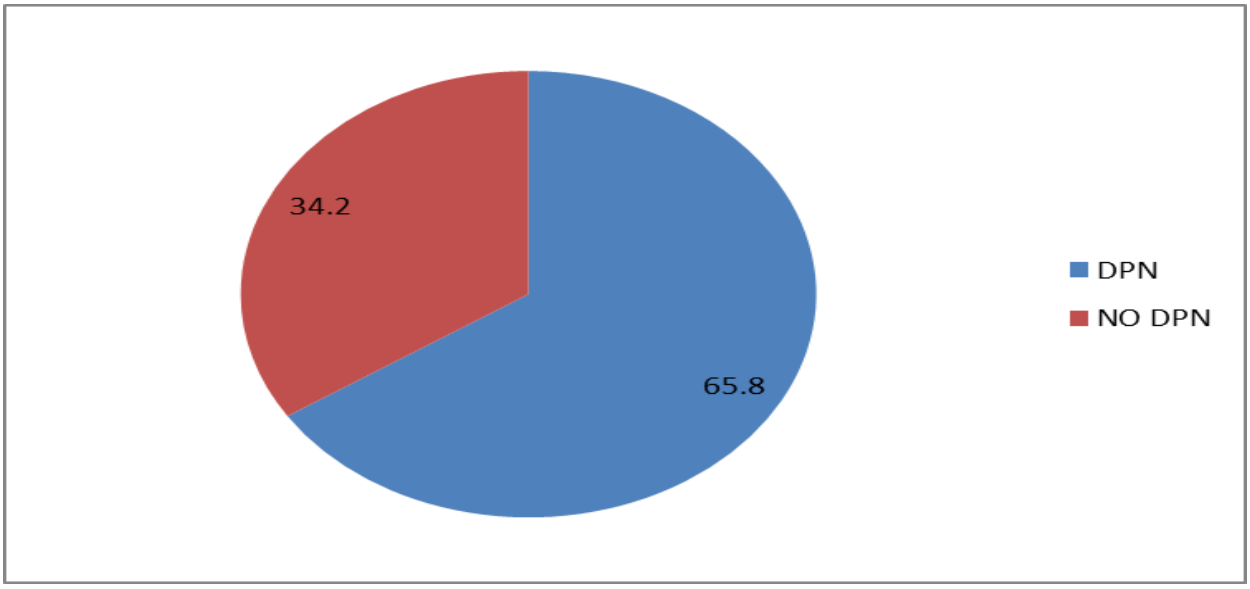

Figure 3 Prevalence of DPN

In figure 3,the overall prevalence of diabetic peripheral neuropathy among adult diabetic patients attending Kampala University-Teaching Hospital was 65.8% (210/319) (95% CI 60.4-70.9) by using the Neuropathy Disability Score (NDS) .The NDS system is a criteria made of Peripheral Neuropathy score range from 0 – 10 which could also be used to assess severity of peripheral neuropathy by considering four (4) parameters: vibration sense by using a 128 Hz tuning fork (0=present,1=reduced/absent for each foot),temperature sensation by using a cold tuning fork (0=present,1=reduced/absent for each foot),pin-prick sensation by a monofilament test (0=present,1=reduced/absent for each foot and Ankle reflex/Achilles Tendon reflex by using a patellar hammer (0=normal,1=present with reinforcement, 2=absent per side). Absence of DPN (normal) was considered when the score was from 0 up to 2. The severity of DPN was graded as follows: mild (scores: 3–5), moderate (scores: 6–8), and severe (scores: 9–10). In our study, 210 participants had Diabetic Peripheral Neuropathy (65.8%) from which, 44.8% had mild Diabetic Peripheral Neuropathy (DPN), 42.4% had moderate Diabetic Peripheral Neuropathy and 12.8% had severe Diabetic Peripheral Neuropathy.

DISCUSSION

Prevalence of Diabetic Peripheral Neuropathy among adults with Diabetes Mellitus attending Kampala International University Teaching Hospital

The overall prevalence of Peripheral Neuropathy among adult diabetic patients attending Kampala International University- Teaching Hospital was 65.8 % (95% CI 60.4-70.9). Our results are similar to the global prevalence of Diabetic Peripheral Neuropathy [17]. This could be explained by the fact that the global prevalence considers all the population by using a standard score (NDS) for assessing Diabetic Peripheral Neuropathy. The prevalence of Diabetic Peripheral Neuropathy in this study is different from some researchers conducted in some countries such as India where the

prevalence of Diabetic Peripheral Neuropathy was lower compared to our study [18]. This disparity is due to the age of participants; the previous study enrolled patients from 30 years and above and considered all neurological complications in Diabetic patients. The prevalence of Diabetic Peripheral Neuropathy in our study is similar to a study done in Morocco [5]. The reason of the similarity could be because of almost the same social conditions as African countries and methods used for the assessment of Diabetic Peripheral Neuropathy were the same. This current study found a lower prevalence compared to a study done in Nigeria [19,20], because our study included all types of Diabetes whereas this other one considered only patients with type 2 Diabetes Mellitus. The prevalence of Diabetic Peripheral Neuropathy in our study was higher than those in studies done in Cameroon [7,21], in Tanzania [9,22,23] and in Kampala [14,24]. In our study, the prevalence is higher likely because of the sample size used which was bigger than in those studies, the tools and criteria used (scores) for the diagnosis of Diabetic Peripheral Neuropathy. Also, the above study done in Kampala was conducted among newly diagnosed DM patients.

CONCLUSION

In conclusion, the prevalence of DPN among DM patients attending KIU-TH was high. Clinicians should start doing a peripheral neurological exam in all DM patients and awareness of health personnel about factors associated with DPN.

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