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Research Article

Evaluation of Proteinuria in Diabetic Patients Attending Gitwe District Hospital

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Abstract

Background: Proteinuria is a serious condition in which body proteins leak into urine due to kidney dysfunction nearly always caused by elevated serum glucose due to prolonged diabetes. Proteinuria occurs and affects individuals with diabetes, approximately 25% of diabetic patients may have proteinuria.

Aim: The aim of this study is to assess the levels of serum glucose and proteins in urine and their association in diabetic patients attending Gitwe District Hospital.

Methodology: The study population mainly comprised of diabetic patients, 110 study participants were included. Blood was drawn from finger for testing serum glucose using glucometer and urine samples were collected from diabetic patients and samples were analyzed in parasitology service using urine chemistry strips for proteins in urine testing.

Results: During data analysis, SPSS version 22 was used, the majority were female with 66.4% while 33.6% were male. The highest frequency of participants presented in this study were 27(24.6%) found in [43-52] years old. The mean age was 53 years ± 13.882 SD (ranged from 23 to 86 years). 53.7% had normal serum glucose level while 46.3% had high serum glucose level. However, 63.6% had no proteinuria while 20.0% had trace, 11.8% had mild and 4.6% had moderate proteinuria levels. Association between serum glucose and proteinuria was analyzed for statistical significance with Chi-square test and it was statistically significant as their p values were below 0.05(P-value of 0.000).

Conclusion: The study found that high serum glucose level leads to the presence of proteins in the urine. This study recommends regular monitoring of serum glucose levels, as well as routine urine tests to detect proteinuria as essential components of diabetes management and other researchers to study the effects of proteinuria in diabetic patients.

Keywords: Proteinuria, serum glucose, proteins, diabetic patients

INTRODUCTION

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. Insulin is a hormone that regulates blood glucose level in body. Worldwide the prevalence of diabetes was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030[1]. The spread will be higher in developing countries (69%) compared to developed countries (20%). Most of diabetic patients will have type 2 diabetes. In 2014, 8.5% of adults aged 18 years and older had diabetes. In 2019, diabetes was the direct cause of 1.5 million deaths and 48% of all deaths due to diabetes occurred before the age of 70 years[2].

Another 460 000 kidney disease deaths were caused by diabetes, and raised blood glucose causes around 20% of cardiovascular deaths. Between 2000 and 2019, there was a 3% increase in age-standardized mortality rates from diabetes. In lower-middle-income countries, the mortality rate due to diabetes increased 13% [3]. Type 2 diabetes is recognized as a serious public health concern with a considerable impact on human life. More than 95% of people with diabetes have type 2 diabetes. In type 2 diabetes, there are primarily two interrelated problems at work. pancreas does not produce enough insulin, a hormone that regulates the movement of sugar into your cells and cells respond poorly to insulin and take in less sugar[4].

Type 2 diabetes is the predominant form of diabetes in sub-Saharan Africa, accounting for over 90% of cases.

The major risk factors for diabetes in sub-Saharan Africa are urbanization, obesity, physical inactivity, and those that are not mutable, such as increasing age and ethnicity[5]. The rising prevalence of diabetes in the region has largely been ascribed to changes in lifestyle and urbanization, resulting in greater levels of obesity and physical inactivity. However, obesity has been uncommon in many parts of the region, largely owing to scarcity of food and high levels of energy expenditure. As recently as 1995 only 1-7.1% of women aged 15-45 years of age in sub-Saharan Africa countries were obese[6].

Namibia and Zimbabwe alone had a prevalence of more than 5%. Yet at the same time, 31% of South African women were obese. Proteinuria is serious condition in diabetic patients. People with diabetes may have damaged nephrons and develop proteinuria. If high blood sugar levels over a number of years damage the kidneys, they may allow too much albumin to be lost from the blood. Proteinuria is a sign that the kidneys have become damaged[7]. The most common cause of proteinuria is diabetes, Albuminuria, also called proteinuria, is a condition in which albumin, a type of protein found in blood plasma. It reaches into the urine[8].

Although very small amounts of protein in urine can be normal, high levels of albumin is one of several indicators of CKD, a common complication of both type 1 and type 2 diabetes. Chronic kidney disease is prevalent in people with diabetes; a recent analysis of NHANES data found that 39.6% of people with diagnosed diabetes, 41.7% of those with undiagnosed diabetes and 17.7% of those with prediabetes had CKD. The presence of proteins in the urine, an early sign of kidney disease. One of the major medical complications of diabetes is diabetic nephropathy[9].

MATERIALS AND METHODS

Study area

The study was carried out at Gitwe District Hospital located in Ruhango District, Southern Province

Study design and period

This study was cross sectional that was carried out on diabetic patients who filled the inclusion criteria at Gitwe District Hospital.

Study population and sample size

The target population were diabetic patients who attended in the study period at Gitwe District Hospital. Sample size was 110 diabetic patients determined by study period based on inclusion and exclusion criteria.

Sample collection and processing

Every patient who filled all inclusion criteria was drawn blood from finger used to test for serum glucose using glucometer and was given urine container for urine samples then transferred to Gitwe District Hospital laboratory in parasitology department for urine chemistry analysis specifically proteinuria using urine chemistry test strips for analysis according to standard operating procedures (SOPs), purposive sampling method was used.

Statistical analysis

Collected data were analyzed using descriptive statistical analysis approach with SPSS (Statistical package for the social sciences). The presentation of results was done using tables. Descriptive statistics was used to calculate the frequency and percentages while the Association between serum glucose and proteinuria were tested using Chi-square test.

Results And Discussion

Demographic characteristics of participants

This cross-sectional study was carried out on diabetic patients who attended Gitwe District Hospital. 110 diabetic patients were included; majority were 66.4% female while 33.6% were male. The mean age was 53 years ± 13.882 SD (ranged from 23 to 86 years), The highest frequency of participants present in this study were 27(24.6%) between [43-52] years.

Table 1: Demographic characteristics of participants

Group characteristics			**Frequency**	**Percent**
Gender	F		73	66.4
	M		37	33.6
	Total		**110**	**100.0**
Age group	[23-32]		6	5.5
	[33-42]		21	19
	[43-52]		27	24.6
	[53-62]		24	21.8
	[63-72]		20	18.2
	[73-82]		10	9.1
	[83-92]		2	1.8
	Total		**110**	**100.0**
Age	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
	23	92	53.918	13.882

In 110 diabetic patients who were included in the study, seven classes of participants were divided according to the ages (Table 2), The highest frequency of participants were 27(24.6%) observed in [43-52] years and the smallest was found [83-92] years with frequency of 2(1.8%).

A total of 472 participants with diabetes were recruited (62, 177, 65, 94 and 74 respectively from Butaro, Kabgayi, Kirehe, Ruhengeri and Rwinkwavu) and enrolled in the study, with a response rate of 100% in both sexes, of which 62.5% were women which is similar to this study as the majority were women (66.4%), with an age range of 5 to 86 years which values the same range of ages within this study[10]. According to the World Health Organization, 2.8% of the Rwandan population is estimated to have diabetes. A report by WHO also shows that in 2018 the prevalence of diabetes in Rwanda was 2.7% in female and 3.0% in male which correspond to a total of 2.8% which oppose the study on prevalence of diabetes based on sex[11].

Levels of serum glucose in diabetic patients

This was cross-sectional study which included 110 diabetic patients who attended Gitwe District Hospital. The mean serum glucose level was 142.05 mg/dl ± 61.420 SD with minimum level of 83 mg/dl and maximum level of 404 mg/dl. The frequency of 59(53.7%) had normal serum glucose level while the frequency of 51(46.3%) had high serum glucose level, the level of serum glucose was distributed according to gender as summarized in table 2.

Table 2: Distribution of serum glucose level among diabetic patients

Gender	Normal serum glucose	High serum glucose	Total	Mean	Standard deviation
Male	19(17.3%)	18(16.3%)	37(33.6%)	142.05	61.420
Female	40(36.4%)	33(30%)	73(66.4%)		
Total	59(53.7%)	51(46.3%)	110(100%)		

Many glucose level results of the participants had values close to the mean. Therefore, there was elevated level of serum glucose level among diabetic patients, as the mean calculated was above the normal range of serum glucose in diabetic patients (80-130 mg/dl)[12].

According to a study in 2016 in the U.S., there were over 7.8 million hospital stays for patients with diabetes. It is reported in 22% to 46% of non-critically ill hospitalized patients, which is similar to the results obtained in this study (46.3%)[13]. Results indicates that hyperglycemia in patients with diabetes can be associated with an increased risk of complications including failure to take prescribed insulin which lead to uncontrolled blood sugar levels, consuming high-carbohydrate, sugary foods, and drinks can cause a rapid increase in blood sugar levels[14].

Levels of proteins in urine in diabetic patients

The study findings of 110 diabetic patients who attended Gitwe District Hospital shows that the frequency of 30(36.4%) had abnormal level of proteinuria while the frequency of 70(63.6%) had no proteinuria. The proteinuria levels were distributed according to various grades as shown in table 3.

Table 3: Level of proteins in urine among diabetic patients

Proteins in urine (mg/dl)	Protein dipstick grading	Frequency	Percent (%)
0	Negative	70	63.6
15	Trace	22	20.0
30	1+ (Mild)	13	11.8
100	2+ (Moderate)	5	4.6
≥300	3+ (Severe)	0	0.0
Total		110	100.0

These results showed that a substantial portion of the sample population 63.6% had no proteinuria, while a smaller percentage of individuals exhibit trace (20.0%), 11.8% with mild (1+) proteinuria, and 4.6% has moderate (2+) proteinuria levels and no individual that has severe (3+) proteinuria. The presence of trace to severe proteinuria in individuals indicate slightly higher level of proteins in the urine, which suggests possible kidney dysfunction[15].

Comparing to the study which showed proteinuria levels in the acute kidney injury groups were well matched,

with 61% of patients having no proteinuria at baseline, 17% with trace proteinuria, 12% with 1+ proteinuria, 7% with 2+ proteinuria, and 3% with 3+ proteinuria[16]. Which is similar to the results obtained in this study.

A study illustrated that in a population-based study in southern Wisconsin, 1370 diabetic persons diagnosed after 29 years of age were examined using standard protocols to determine the prevalence of proteinuria and associated risk variables. Proteinuria (≥0.30 g/L) was present in 18.0% of persons taking insulin and 12.2% of the persons not taking insulin. Proliferative retinopathy and proteinuria were associated with each other. Which is dissimilar with the results obtained in this study, where the prevalence of proteinuria (≥300 mg/dl) was 16.4%. this may vary according to difference in sample size and study design used[17].

Association between serum glucose and proteins in urine in diabetic patients

Chi-square test was used to determine the association between serum glucose and proteins in urine in diabetic patients who attended Gitwe District Hospital. The association between serum glucose and proteins in urine was found to be statistically significant of P-value 0.000 and Odds Ratio was 33.000. As shown in Table 4.

Table 4: Association between serum glucose and proteins in urine

		Proteins in urine		Total	Pearson chi-square (P- value)	Odds ratio
		Positive	Negative			
Serum glucose	High	36	15	51	0.000	33.000
	Normal	4	55	59		
Total		40	70	110		

P-value of 0.000 indicates that there is statistically significant association between serum glucose and proteinuria in diabetic patients, an odds ratio of 33.000 indicates a strong association between serum glucose and proteinuria. An odds ratio of 33.000 indicates that the chances of developing proteinuria are 33 times higher in individuals with elevated or high serum glucose compared to those with normal serum glucose levels.

High serum glucose levels in individuals with prolonged diabetes leads to glomerular hyperfiltration, glomerular hyperfiltration is a condition in which the kidneys filter blood at a rate higher than normal through the glomeruli. Prolonged glomerular hyperfiltration damages the glomerular filtration barrier which increases permeability and allows albumin and other proteins to leak into the glomerular filtrate. As a result, these proteins appear in the urine, leading to proteinuria, a condition when there is an increase in the amount of protein discharged in the urine. Normally, when the kidneys are healthy, proteins are effectively reabsorbed and kept from excreting in the urine, but when the kidneys are damaged, proteins may leak into the urine[18].

A study conducted by different researchers showed that diabetes-related kidney failure is caused by high blood sugar levels ,approximately one-third of patients with diabetes mellitus develop Diabetic Nephropathy (DN), is a serious complication of type I and II diabetes, the main initiator for DN is chronic hyperglycemia which is mainly characterized by proteinuria, suggested that the strict control of blood glucose in the early stage of diabetes can significantly reduce the incidence of diabetic microvascular[19]. Which is similar to this study as elevated serum glucose tends to lead to proteinuria which is an early sign of diabetic nephropathy.

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