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Research Article

Assessment of Glucosuria and Ketonuria in Diabetic Patients Attending Gitwe District Hospital

ISHIMWE Alain Prudence [1,2*], GATEMBEZI Tharcisse[2], MUTABAZI Donatien [2], NSHUTI Jean Paul [3], ITANGISHATSE Bernard [3], HAKIZIMANA Philippe [4], NSABIYAREMYE Lauben [5]

[1:] Ines-Ruhengeri, Faculty of Applied Fundamental Sciences, Department of Biomedical Laboratory Sciences, Rwanda.

[2:] University of Gitwe, Faculty of Education, Department of Sciences, Rwanda

[3:] Gitwe District Hospital, Rwanda

[4:] University of Gitwe, Director of Research, Rwanda

[5:] University of Gitwe, Director of quality assurance

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***Address for Correspondence:**

ISHIMWE Alain Prudence, Ines-Ruhengeri, Faculty of Health Sciences, Department of Biomedical Laboratory Sciences, Rwanda.

Abstract

Background: Glucosuria and ketonuria are serious condition which mostly occur and affect in diabetes mellitus. Glycosuria is a rare condition in which kidney excrete glucose into the urine, nearly always caused by elevated blood glucose levels, most commonly due to untreated diabetes mellitus. while Ketonuria is a medical condition in which ketone bodies are present in the urine. It is seen in conditions in which the body produces excess ketones as an alternative source of energy. It is seen during starvation or more commonly in type I diabetes mellitus.

Aim: This cross-sectional study was conducted with the aim of assessing the levels of glucosuria and ketonuria in diabetes patients attending Gitwe District Hospital.

Methodology: The glucosuria and ketonuria in diabetes patients were tested. The study populations mainly comprised of diabetes patients, 116 study participants were included, the majority were 64.7% female while 35.3% were male. Urine sample was collected from diabetes patients and samples analysis was performed in biochemistry service of Gitwe District Hospital for glucosuria and ketonuria analysis using urine chemistry strips.

Results: During data analysis, the highest frequency of participants present in this study were (34.6%) between 51-60 years old. The mean age was 51years ± 10.787 SD (ranged from 26 – 79 years). 21.5% patients experienced glucosuria and 11.1% lived with ketonuria. correlation between glucosuria and ketonuria was found to be highly positive and statistically significant of 0.001 with Correlation Coefficient (r) of 0.886, which indicates that when glucosuria increase leads to increase of ketonuria too.

Conclusion: There are very few studies on glucosuria and ketonuria in diabetes patients, researchers are recommended to conduct researches related to this. Further researches are recommended to study the effects of change of glucosuria and ketonuria especially their association in diabetes patients.

Keywords: Glucosuria, Ketonuria, Diabetes, Insulin

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 sugar. Hyperglycemia, or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems. There are two types of diabetes. Type 1 diabetes (previously known as insulin-dependent, juvenile or childhood-onset) is characterized by deficient insulin production and requires daily administration of insulin. In 2017 there were 9 million people with type 1 diabetes; most of them live in high-income countries. Neither its cause nor the means to prevent it are known[1].

Type 2 diabetes (formerly called non-insulin-dependent, or adult-onset) results from the body's ineffective use of insulin. More than 95% of people with diabetes have type 2 diabetes. This type of diabetes is largely the result of excess body weight and physical inactivity[2]. Symptoms may be similar to those of type 1 diabetes but are often less marked. As a result, the disease may be diagnosed several years after onset, after complications have already arisen. Until recently, this type of diabetes was seen only in adults, but it is now also occurring

increasingly frequently in children[3]. Symptoms include excessive excretion of urine (polyuria), thirst (polydipsia), glucose in urine (Glucosuria), ketone bodies in urine (ketonuria), constant hunger, weight loss, vision changes, and fatigue. These symptoms may occur suddenly[4].

Glucosuria is one of the most condition occur often to diabetic patient. the term glucosuria is conventionally reserved for pathologic amounts of urine glucose (more than 25 mg/dl in random fresh urine), The renal tubule will reabsorb almost all the glucose present in the normal glomerular filtrate[5]. Glucosuria occurs when that balance is lost when the amount of glucose in the glomerular filtrate exceeds the capacity of the renal tubule to reabsorb it. The balance can be lost either when the plasma glucose is elevated (e.g., in diabetes mellitus) or when the absorptive capacity of the tubule is impaired (e.g., pregnancy)[6]. Glycosuria during hyperglycemia is the result of an excess of renal glucose load (plasma glucose concentration times rate of glomerular filtration) over glucose reabsorptive capacity. As such, it occurs in a wide variety of conditions associated with hyperglycemia[7].

Ketonuria is also one of the conditions that happen most in diabetes patient. Ketone bodies (acetoacetic acid, beta-hydroxybutyric acid, and acetone) are insignificant in the blood and urine of normal individuals in the postprandial or overnight-fasted state[8]. However, these ketoacids become important sources of metabolic energy in circumstances in which the availability of glucose is restricted, as during prolonged fasting, or when the ability to use glucose is greatly diminished, as in decompensated diabetes mellitus[9].

METHODOLOGY

Study area and design

The study was carried at Gitwe District Hospital located in Ruhango district. This study was cross sectional that carried out on diabetic patients attended Gitwe District Hospital.

Study population

The target population was diabetic patients who attended Gitwe District Hospital during the research period

Sample collection and processing

Every diabetic patient who attended Gitwe District Hospital within the period under review was given urine container for urine sample then transferred to Gitwe District Hospital lab in biochemistry department for urine chemistry analysis specifically glycosuria ad ketone bodies using urine strips for analysis. Every patient with inclusion criteria was included in this research.

Statistical data analysis

Collected data was analyzed using descriptive statistical analysis approach with SPSS (Statistical package for the social sciences).

RESULTS AND DISCUSSION

Socio- demographic characteristics of participants

This cross-sectional research was included diabetic patients who attended Gitwe District Hospital. 116 diabetes patients were included, 64.7% were female while 35.3% were male. The mean age was 51years ± 10.787 SD (ranged from 26 – 79 years) (Table 2). The highest frequency of participants present in this study were (34.6%) between 51-60 years old (Table 3). 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 type 2 diabetes in Rwanda was 2.7% in female and 3.0% in male which correspond to a total of 2.8%[10]. Which is still value in this results.

Table 1: Demographic characteristics according to the sex and their frequencies

		Frequency	Percent
Valid	**F**	75	64.7
	M	41	35.3
	Total	116	100.0

Table 2: Mean of age of diabetic patients

	N	Minimum	Maximum	Mean	Std. Deviation
Age	**116**	**26**	**79**	**51.90**	**10.787**

In 116 patients who were included in the study, Six classes of participants according to the ages The highest frequency of 40(34.5%) observed in (51-60) age and the smallest was founded under 30 years age with frequency of 3(2.6%). In (31-40) frequency founded was 16(13.8%), and the frequency of 33(28.4) was founded in (41-50) age. Age of (61-70) has frequency of 20(17.2%) and frequency of 4(3.4%) was found in patients older than 71. Compared to another study, Two hundred and fifty (250) participants were selected as study population, The mean age was 57years ± 12.8 SD (ranged from 26 – 79 years and The highest number of

participants was from 51 - 60 years' age group (31.20%)[11]. A total of 472 participants with diabetes fulfilling the inclusion criteria, were recruited (62, 177, 65, 94 and 74 respectively from Butaro, Kabgayi, Kirehe, Ruhengeri and Rwinkwavu) and enrolled in the study, The mean ± standard deviation (SD) age of the participants was 40.2 ± 19.1 years, with an age range of 5 to 86 years, which means that both studies varies the same range of ages[12].

Table 3: Demographic characteristics according to the ages and their frequencies

		Frequency	Percent
Valid	Under 30	3	2.6
	31-40	16	13.8
	41-50	33	28.4
	51-60	40	34.5
	61-70	20	17.2
	Above 71	4	3.4
	Total	116	100.0

Levels of glucosuria among diabetic patients attended Gitwe District Hospital.

This cross-sectional study which included 116 diabetes patients, the highest frequency founded were 91 (78.4%) of patient with no glucosuria founded in urine. 21.5% patients experienced glucosuria, 5(4.3%) had 110 mmol/l, 60mmol/l and 30mmol/l each founded in 7(6%) and 15mmol/l founded in 5.2% with frequency of 6. Other researchers showed that About 40 to approximately 60 percent of diabetic patients are affected by abnormal increased glucosuria [more than 25 mg/dl in random fresh urine], results from either an elevated plasma glucose, an impaired renal glucose absorptive capacity, or both[13]. Glycosuria was defined as a record of at least 13.9 mmol/L or 250 mg/100 mL on at least two occasions at any time during diabetes and gestational diabetes[14].

Table 4: Frequency and percent of glucosuria among diabetic patients

		Frequency	Percent
Valid	0	91	78.4
	15	6	5.2
	30	7	6.0
	60	7	6.0
	110	5	4.3
	Total	116	100.0

Levels of ketonuria among diabetes patients attended Gitwe District Hospital.

In this cross-sectional study, which included 116 diabetic patients at Gitwe District Hospital, the level of ketonuria was proven to be elevated comparing with the normal range, 11.1% lived with ketonuria with a frequency of 13. In those positives ketonuria 3.4% had 16.0 mmol/l, 2.6% had 8.0mmol/l, 1.7 had 4.0 mmol/l and 1.5mmol/l was in 3.4%. A study reported that around one-tenth of diabetic patients in the world suffer from ketoacidosis, which is characterized by a serum glucose level greater than 250 mg per dL, a pH less than 7.3, an elevated serum ketone level, and dehydration. Insulin deficiency is the main precipitating factor. These ketones bodies especially acetone at level of 49% of all diabetic patients live with this problem[15]. Another study stated that Ketonuria occurs more frequently than ketoacidosis does in patients with Type 2 diabetes and may portend serious future events. 228 adult African American and Hispanic/Latino diabetes patients, 112 (49%) had ketonuria[16].

Compared to a study made on Physicians routinely order urinary ketone testing for most patients with diabetes mellitus upon hospitalization, even in the absence of a history of diabetic ketoacidosis. To determine whether testing for urinary ketones is clinically useful in patients with non-insulin-dependent diabetes mellitus (NIDDM), a retrospective review was undertaken of 152 charts of patients admitted to the hospital during a 6-mo period with the diagnosis of diabetes mellitus. Of the 135 patients with NIDDM, 96% had routine testing performed for urinary ketones. Surprisingly, 26% of the patients with NIDDM had positive urine ketones at some time during hospitalization, and the degree of ketonuria was markedly greater than that of control NIDDM outpatients and nondiabetic hospitalized patients[17].

Table 5: Frequency and percent of ketonuria among diabetic patients

		Frequency	Percent
Valid	.0	103	88.8
	1.5	4	3.4
	4.0	2	1.7
	8.0	3	2.6
	16.0	4	3.4
	Total	116	100.0

Correlation between glucosuria and ketonuria in diabetic patients attended Gitwe District Hospital

Pearson correlation was used to determine the correlation between glucosuria and ketonuria in diabetic patients attended Gitwe District Hospital. As shown in Table 6 Pearson product correlation between glucosuria and ketonuria was found to be highly positive and statistically significant of 0.001 with Correlation

Coefficient (*r*) of 0.886, which indicates that when glucosuria increase leads to increase of ketonuria too.

Table 6: Correlation between glucosuria and ketonuria

		Glucosuria	Ketonuria
Glucosuria	Pearson Correlation	1	0.886
	Significant		<.001
Ketonuria	Pearson Correlation	0.886	1
	Significant	<.001	

Compared to study of Luethi performed a prospective observational cohort study of 60 critically ill diabetic patients with blood and/or urine ketone bodies tested in ICU. All patients were treated according to a liberal glucose protocol targeting a blood glucose level (BGL) between 10 and 14 mmol/l in a single tertiary intensive care unit in Australia. measured quantitative bedside blood glucose, and semi-quantitative urine ketones on ICU admission and daily during ICU stay, for a maximum of 10 consecutive days. His Results showed that median blood ketones level on admission was 0.3 (0.1, 0.8) mmol/l. Ketoacidosis was rare (3 %), but some level of ketosis (β-OHB ≥0.6 mmol/l) was found in 38 patients (63 %) early during their ICU stay, linear regression analysis there was association between blood ketone levels and urine ketone bodies, in contrast, ketonuria levels tended to be higher (P = 0.0774)[18].

Newton & Raskin reviewed 176 admissions of patients with moderate to severe DKA. Patients were classified as having type 1 or type 2 diabetes 138 patients admitted for moderate to severe DKA, 30 had type 2 diabetes. A greater proportion of the type 2 diabetes group was Latino American or African American (P 0.001). Thirty-five admissions (19.9%) were for newly diagnosed diabetes, association of hyperglycemia with ketone bodies in urine analysis shows highly positive and statistically significant (P = 0.001, *R* = 0.754) with ketone bodies in urine[19].

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