Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231-6345 (Online)
An Open Access, Online International Journal Available at http://www.cibtech.org/jls.htm
2014 Vol. 4 (3) July-September, pp.411-416/Kamal
Research Article

IMPACT OF DIABETES ON RENAL FUNCTION PARAMETERS

***Azra Kamal**
**Forensic Science Laboratory, C.I.D (Police), Patna-800023, Bihar, India*
**Author for Correspondence*

ABSTRACT
The clinical chemistry of a diabetic includes marked elevation of the blood glucose levels (hyperglycemia). It appears to exert a major effect on a number of major organ systems especially kidney. It influences on renal function parameters. The blood urea and serum creatinine levels are a valuable tool in the determination of renal function. This study was conducted to investigate the impact of diabetes on renal function parameters like blood urea and serum creatinine. Estimation of blood glucose, blood urea and serum creatinine levels were done in forty (40) diabetic blood samples. Blood glucose level in three categories ranges from 130-190 mg/dl, 190-260mg/dl and 260-390mg/dl were selected in which percent variation in urea and creatinine levels from their normal range corresponding to blood glucose level was observed.15 samples were found in both first (130-190 mg/dl) and second (190-260 mg/dl) category. In both categories concentration of urea haven't showed significant fluctuation from their normal range than creatinine. In the third at highest hyperglycemic category (260 – 390 mg /dl), 10 samples were found in which the deflected samples of urea showed 6.66 to 26.66% variation whereas creatinine showed 85.71 to 100% variation from their normal range. In this highest hyperglycemic category also the concentration of urea haven't showed significant fluctuation from their normal range whereas the percent variation in creatinine concentration was found very high as compare to two other categories. In conclusion, diabetes influences renal parameters like urea and creatinine and creatinine showed significant variation from their normal range than urea. Deflection in urea and creatinine level from their normal range corresponding to increased blood glucose level indicates reduction in kidney function in diabetic patients. The measurement of urea and creatinine level allows early identification of patients with prerenal problems. It might provide significant prognostic benefits in terms of global diabetic nephropathy risk and management of the patients. Further study is warranted to explore this association.

Keywords: *Blood Glucose, Blood Urea, Serum Creatinine, Hyperglycaemia, Renal Function*

INTRODUCTION
Diabetes mellitus (DM) is a lifelong progressive disease. It is classified as a group of heterogeneous metabolic disorders characterized by hyperglycemia as a common feature (Babitha *et al*., 2010) caused by either lack of insulin secretion or decreased sensitivity of the tissues to insulin (Guyton and Hall, 2004). It can lead to severe cardiovascular, renal, neurologic and retinal complications (Shahid and Mahboob, 2006). Diabetic nephropathy is the kidney disease that occurs as a result of diabetes (Dabla, 2010). It is a clinical hall mark of microangiopathy and is the most important single disorder leading to renal failure in adults (Ramachandran *et al*., 1997). The specific pathological changes in the kidney, the clinical course, and the overall risk to develop nephropathy are quite similar in both types of diabetes (Mauer and Chavers, 1985), (Pugh *et al*., 1993).
The most common lesions involve the glomeruli and are associated clinically with three glomerular syndromes, including non nephritic proteinuria, nephrotic syndrome and chronic renal failure (Schrier and Gottschalk, 1993). Urea and creatinine are good indicators of a normal functioning of the kidney and increase of the substances in the serum are indicates kidney dysfunction (Anderson, 1996). The serum creatinine concentration is widely interpreted as a measure of the glomerular filtration rate (GFR) and is used as an index of renal function in clinical practice (Ronald *et al*., 1993-1953, 1992). This study was conducted to establish relationship of blood glucose level with urea and creatinine levels, in diabetic subjects.

MATERIALS AND METHODS

Forty (40) diabetic fasting blood samples were collected from Patna Medical College and Hospital, Patna and analysed in Department of Biochemistry, Patna Science College, Patna University, Patna. The main variables under study were blood glucose, blood urea, and serum creatinine levels. Estimation of blood glucose was done by Glucose Oxidase and Peroxidase (GOD- POD) method (Trinder, 1969). Blood urea was estimated by Berthelot's method (Berthelot 1859) while serum creatinine was estimated by alkaline Jaffe's Picrate method (Owen *et al*., 1954).

RESULTS AND DISCUSSION

Results

In present study a total of forty (40) blood samples of diabetic patients were analyzed. Blood glucose level in three categories ranges from 130-190 mg/dl, 190-260mg/dl and 260-390mg/dl were selected as shown in (Table 1), (Table 2) and (Table 3). Percent variation in urea and creatinine level from their normal range corresponding to blood glucose level in all the three categories was observed.

Table 1: Biochemical Parameters of Blood Urea and Serum Creatinine concentration at Blood Glucose level 130-190mg/dl)

Serial No	Blood Glucose 70-120 mg/dl	Percent Variation	Blood Urea 13-45 mg/dl	Percent Variation	Serum Creatinine 0.6-1.4 mg/dl	Percent Variation
1.	130	8.33	17	0.00	0.6	0.00
2.	133	10.83	31	0.00	1.7	21.42
3.	145	20.83	19	0.00	1.7	21.42
4.	147	22.50	20	0.00	1.6	14.28
5.	154	28.33	27	0.00	1.4	0.00
6.	155	29.16	18	0.00	0.7	0.00
7.	160	33.33	35	0.00	1.6	14.28
8.	165	37.50	44	0.00	1.2	0.00
9.	165	37.50	46	2.22	1.7	21.42
10.	170	41.66	43	0.00	2.0	42.85
11.	173	44.16	31	0.00	1.5	7.14
12.	175	45.83	47	4.44	1.5	7.14
13.	180	50.00	47	4.44	1.3	0.00
14.	185	54.16	43	0.00	2.4	71.42
15.	190	58.33	53	17.77	2.0	42.85

Table 2: Biochemical Parameters of Blood Urea and Serum Creatinine concentration at Blood Glucose level 190-260mg/dl)

Serial No.	Blood Glucose 70-120 mg/dl	Percent Variation	Blood Urea 13-45 mg/dl	Percent Variation	Serum Creatinine 0.6-1.4 mg/dl	Percent Variation
1.	191	59.16	27	0.00	0.6	0.00
2.	191	59.16	31	0.00	0.6	0.00
3.	192	60.00	29	0.00	0.7	0.00
4.	194	61.66	44	0.00	1.4	0.00
5.	198	65.00	29	0.00	1.2	0.00
6.	198	65.00	48	6.66	1.6	14.28
7.	199	65.83	51	13.33	1.6	14.28
8.	200	66.66	44	0.00	2.0	42.85
9.	200	66.66	47	4.44	2.2	57.14
10.	205	70.83	34	0.00	1.8	28.57
11.	217	80.83	49	8.88	1.2	0.00
12.	235	95.83	50	11.11	1.7	21.42
13.	235	95.83	53	17.77	2.5	78.57
14.	255	112.5	55	22.22	2.5	78.57
15.	260	116.6	44	0.00	1.7	21.42

Table 3: Biochemical Parameters of Blood Urea and Serum Creatinine concentration at Blood Glucose level 260-390mg/dl)

Serial No	Blood Glucose 70-120 mg/dl	Percent Variation	Blood Urea 13-45 mg/dl	Percent Variation	Serum Creatinine 0.6-1.4 mg/dl	Percent Variation
1.	263	119.1	44	0.00	1.4	0.00
2.	263	119.1	35	0.00	1.2	0.00
3.	264	120.0	44	0.00	2.6	85.71
4.	267	122.5	48	6.66	2.6	85.71
5.	279	132.5	45	0.00	2.8	100
6.	289	140.8	55	22.22	2.7	92.85
7.	340	183.3	49	8.88	1.4	0.00
8.	340	183.3	57	26.66	2.8	100
9.	381	217.5	56	24.44	2.7	92.85
10.	390	225.0	56	24.44	2.7	92.85

15 samples were found in the first hyperglycemic category (130-190 mg/dl).Variation among urea and creatinine concentration were analyzed.11 samples of urea were found in their normal range and 4 samples showed variation from their normal range. The percent variation for these samples varied from 2.22– 17.77% whereas for creatinine out of 15 samples , 5 samples were found in their normal range and 10 samples showed variation from their normal value and its percent variation value varied from 7.14 – 71.42%. It was analysed that at hyperglycemic level the concentration of creatinine showed maximum variation from their normal range as compared to urea (Figure 1).

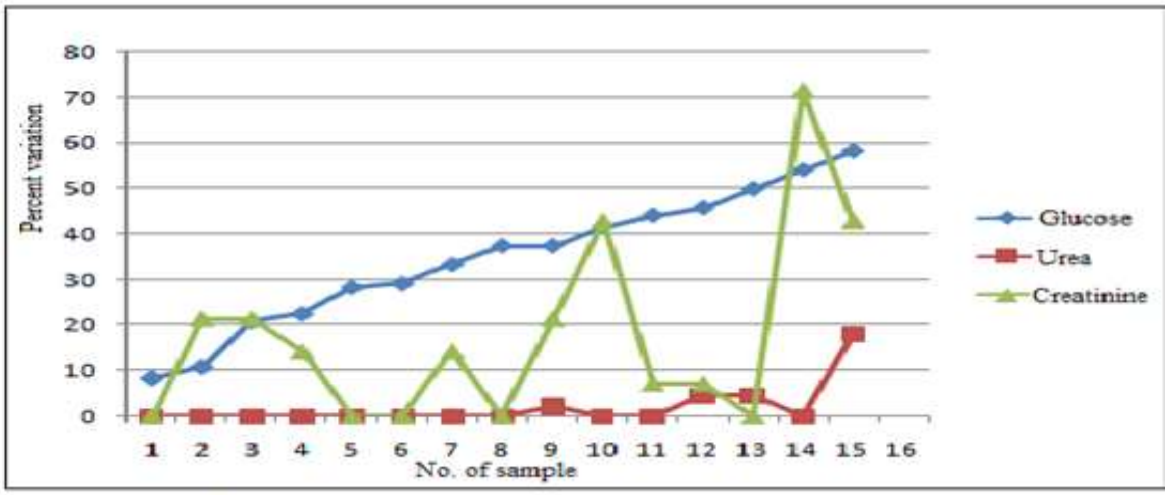

Figure 1: Percent variation at glucose level 130-190 mg/dl

In the second hyperglycemic category (190-260 mg/dl). 15 blood samples were found in which for urea out of 15 samples, 8 samples were found in their normal range where as 7 samples showed variation from their normal range and it's percentage variation value varied from 4.44-22.22% while for creatinine, out of 15 samples, 6 samples were found in their normal range and 9 samples showed variation from their normal range. The percent variation value varied from 14.28 to 78.57 %. In this category also percentage variation of creatinine showed more variation as compared to Urea (Figure 2).

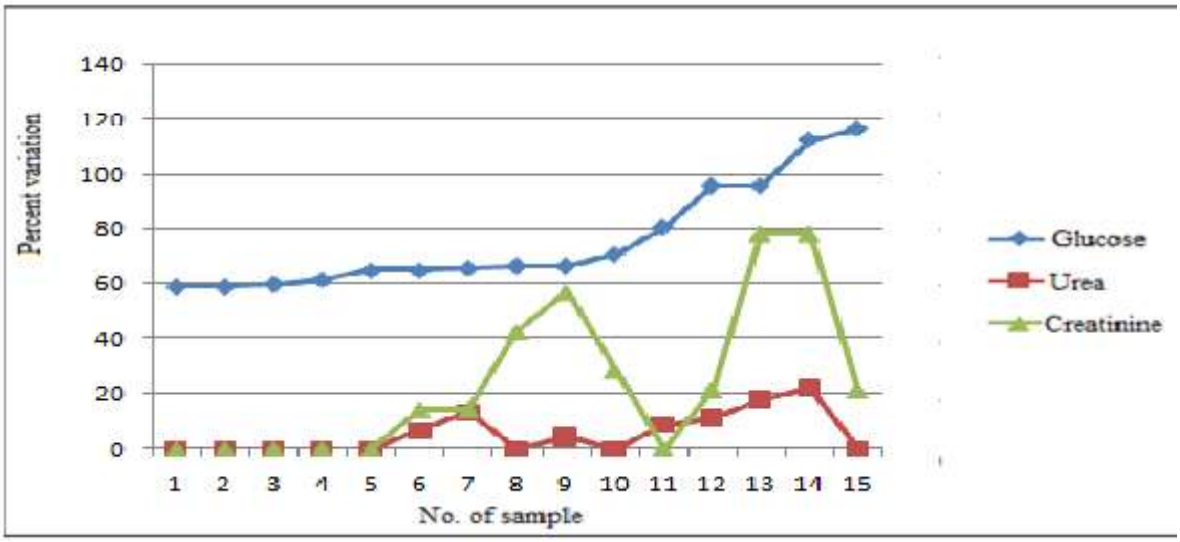

Figure 2: Percent variation at glucose level 190-260 mg/dl

In the third at highest hyperglycemic category (260 – 390 mg /dl), 10 samples were found. The variation among urea and creatinine concentration were analyzed. For urea out of 10 samples, 4 samples were in the normal range indicates no variation from its normal value and 6 samples showed variation from their normal value. The percent variation value varied from 6.66 to 26.66% whereas for creatinine out of 10 blood samples only 3 samples were found in their normal range while 7 samples were found to be deflected from its normal value. The percent variation value for creatinine varied from 85.71-100%. In this highest hyperglycemic category also the concentration of urea haven't showed significant fluctuation

from their normal range and the percent variation in creatinine concentration was found very high as compare to two other categories (Figure 3).

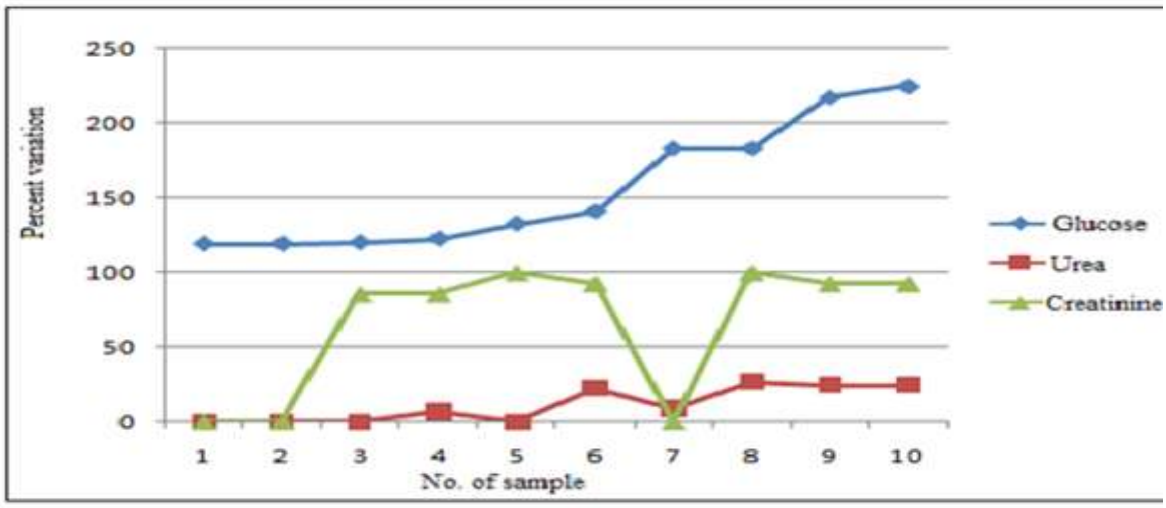

Figure 3: Percent variation at glucose level 260-390 mg/dl

Discussion

The current study was designed to investigate the impact of diabetes on renal function parameters like blood urea and serum creatinine. It was observed that there was a significant relation between blood urea and serum creatinine with hyperglycemia. Measurement of blood urea and serum creatinine is widely regarded as a test of renal function. An increase in urea and creatinine level is seen when kidney is not functioning properly. Increment of blood urea and serum creatinine level with the increment of blood glucose level (as shown in table 1, 2 and 3) clearly indicates that the increase blood glucose level causes damage to the kidney, so kidney is not functioning properly. This corroborates with the findings of Bauza and Mosquera (2003) that hyperglycemia is one of the major causes of progressive renal damage. Ravid *et al.*, (1992) also reported about a reduction in kidney function, reflected by an increase in blood urea and serum creatinine concentration (Ravid *et al.*, 1992). Research conducted by Anjaneyulu et.al 2004 had found that increase urea and serum creatinine in diabetic rats indicates progressive renal damage (Anjaneyulu *et al.*, 2004). Emre *et al.*, (2006) also found similar result that, creatinine levels were significantly higher in the diabetic group than in the control group (Gungor *et al.*, 2006). Diabetes mellitus causes micro and macro-vascular changes in the body and this includes diabetic nephropathy. It does this through hyperglycemia which leads to hyperfiltration and hence increased glomerular filtration rate (Cynda *et al.*, 2004), (Gill *et al.*, 1994). Serum creatinine and urea concentrations change inversely with changes in GFR and are therefore useful in gauging the degree of renal dysfunction (Schutte *et al.*, 1981). This study reports that raised blood urea and serum creatinine levels in diabetic patients may indicate pre-renal problems. The blood urea and serum creatinine are established markers of GFR, though serum creatinine is more sensitive index of renal function.

Conclusion

The present study clearly establishes that diabetes influences renal parameters like blood urea and serum creatinine and creatinine show much variation from their normal range than urea. Deflection in urea and creatinine level from their normal range corresponding to increased blood glucose level indicates reduction in kidney function in diabetic patients. The incidence of diabetes mellitus in human population has reached epidemic proportions worldwide. Meticulous glycemic control can slow the progression of diabetes. Proper strategies should evolve for prevention of diabetes and its complications. Screening for blood urea and serum creatinine will allow early identification of patients with pre renal problem. It might provide significant prognostic benefits in terms of global diabetic nephropathy risk and management of the patients. Further study is warranted to explore this association.

ACKNOWLEDGMENT

I am very grateful to Dr.R.V.N Singh, HOD Dept. of Pathology, Patna Medical College and Hospital, Patna, Bihar, Dr. S.R Padmadeo**,** HOD Dept. of Biochemistry, Patna Science College, Patna, University, Patna and Dr. A.K Ghosh, HOD Dept. of Chemistry, Patna Science College, Patna University, Patna for their guidance ,valuable support, encouragement and providing facilities for carrying out this work.

REFERENCES

Anderson WAD (1996). *Kidneys in Anderson's Pathology,* 5th edition, CV Mosby Company. St Louise Batlomore, Philadephia, Toronto 610-621.

Anjaneyulu, Muragundla, Chopra and Kanwaljit (2004). Quercetin an anti-oxidant bioflavonoid, attenuates diabetic nephropathy in rats. *Clinical & Experimental Pharmacology & Physiology* **31** 244-8.

George B, Cebioglu M and Yeghiazaryan K (2010). Inadequate diabetic care global figures cry for preventive measures and personalized treatment. *EPMA Journal* **1** 13–18.

Berthelot M (1859). *Report Chem. Aplique* **1** 284.

Johnson CA, Levey AS, Coresh J, Levin A, Lau J and Eknoyan G (2004). Clinical practice guidelines for chronic kidney disease in adults part 1. Definition, disease stages, evaluation, treatment and risk factors. *American Family Physicians* **70**(5) 869-876.

Dabla PK (2010). Renal function in diabetic nephropathy *World Journal of Diabetes* **1**(2) 48-56.

Gill GV, Hardy KJ, Patrick AW and Marteson A (1994). Random blood glucose estimation in type 2 diabetes**.** Does it reflect overall glycaemic control? *Diabetic Medicine* **11** 705–708.

Guyton & Hall (2004). *Medical Physiology,* 10th edition (Elsevier) 894.

Gungor ES, Danisman N and Mollamahmutoglu L (2006). Relationship between serum uric acid, creatinine, albumin and gestonal diabetes mellitus. *Clinical Laboratory Medicine* **44**(8) 974-977.

Mauer SM and Chavers BM (1985). Comparison of kidney disease in type I and type II diabetes.

In Vranic M, Hollenberg CH and Steiner G (No Date). Comparison of Type I and Type II Diabetes: Similarities in Etiology, Pathogenesis and Complications, New York, *NY: Plenum Press Advances in Experimental Medicine and Biology* **186** 299-303.

Owen A, Iggo B, Scandrett FJ and Stewart CP (1954). The determination of creatinine in plasma or serum and in urine: A critica1examination**.** *Biochemical Journal* **58** 426.

Pugh JA, Medina R and Ramirez M (1993). Comparison of the course to end-stage renal disease of type I (insulin-dependent) and type II (non-insulin-dependent) diabetic nephropathy. *Diabetologia* **36** 1094-1098.

Ravid M, Savin H, Lang R, Jutrin I, Shoshana L and Lishner M Proteinuria (1992). Renal impairment, metabolic control and BP in type 2 DM a 14 year follow up, report on 195 patients. *Archives of Internal Medicine* **152** 1225.

Ramachandran A, Snehalatha C, Latha E, Vijay V and Viswanathan N (1997). Rising prevalence of NIDDM in an urban population in India. *Diabetologia* **40** 232-237

Ronald D Perrone, Nicolaose E Madias and Andrews Levey (1933-1953) (1992). Serum Creatinine as an index of Renal function New Insights into old concepts. *Clinical Chemistry* **38** 10

Schutte JE, Longhurst JC, Gaffney FA, Bastian BC and Blomqvist CG (1981). Total plasma creatinine: an accurate measure of total striated muscle mass**.** *Journal of Applied Physiology Respiratory, Environmental and Exercise Physiology* **51** 762-766.

Schrier RW and Gottschalk CW (1993). *Disease of the Kidney*, 5th edition, Boston, little, Brown **21** 53-89.

Shahid SM and Mahboob T (2006). Clinical correlation between frequent risk factors of diabetic nephropathy and serum sialic acid**.** *International Journal Diabetes & Metabolism* **14** 138-142.

Trinder P (1969). Determination of glucose in blood using glucose oxidase with an alternative oxygen acceptor. *Annals of Clinical Biochemistry* **6** 24-7.