e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(12); 1-4

Original Research Article

A Comparative Study of the Correction of Serum Urea and Creatinine in Type-1 and Type-2 Diabetes Mellitus

Chhatray Marndi[1], Ashok Kumar Behera[2], Gopabandhu Patra[3]

[1]Assistant Professor, Department of General Medicine, Bhima Bhoi Medical College and Hospital, Balangir, Odisha, India

[2]Associate Professor, Department of General Medicine, Bhima Bhoi Medical College and Hospital, Balangir, Odisha, India

[3]Assistant Professor, Department of Orthopedics, Bhima Bhoi Medical College, Balangir, Odisha, India

Received: 25-09-2023 / Revised: 23-10-2023 / Accepted: 18-11-2023

Corresponding Author: Saubhagya Chhotaray

Conflict of interest: Nil

Abstract:

Background: End stage renal disease (ESRD) and deterioration of the kidney are the associated risk factors of diabetes and may lead to kidney failure with reduced levels of glomerular function which in turn causes the levels of serum creatinine and urea to increase rapidly. The aim of this study is to correlate the levels of urea and creatinine with glycemic index and diabetes duration in type-1 and type-2 DM.

Materials and Methods: The analysis of the levels of serum urea and creatinine was done by collecting the blood samples in patients with diabetes (type-1 and type-2) and non-diabetes in a tertiary care center. A total of 144 males in each group with the age of 35-55 years affected with diabetes and non-diabetic patients were included in this study. Pre and post meal sugar levels, Hemoglobin A1C levels of all the patients were also analyzed. The resulting values were concluded by a one-way variance test. Pearson's correlation coefficient was used to analyze the levels of serum urea and creatinine with Hemoglobin A1C and the period of illness in all the diabetic patients.

Results: A total of 144 participants in each group were selected. The levels of the serum urea and creatinine were found to increase notably in both the types of diabetes patients when compared to patients with no diabetes. The mean ± Standard deviation value of blood sugar level (fasting) of the control group was found to be 83.89±7.50 and the mean ± Standard deviation value of blood sugar level (post meal) of the type 1 DM patients was found to be 97.64±12.50. A significant association of the levels of serum urea and creatinine with Hemoglobin A1C and the period of illness were noted in type-1 diabetes patients only.

Conclusion: The levels of serum urea and creatinine stands as valuable biological markers to predict the proper function of the kidney in patients with diabetes.

Keywords: Urea, creatinine, blood sugar, Hemoglobin A1C, kidney function

Introduction

Diabetes is caused due to a decreased secretion of insulin which results in high blood sugar, affecting the metabolism of the individuals [1]. The associated risk factors may develop in other places like eyes, kidney, heart, nervous system and blood vessels. Globally diabetes stands as a primary cause of morbidity in about 2.5% of the population and reports have shown that this rate may increase rapidly in the upcoming periods. In India, Diabetes is considered as a potential epidemic affecting a large population of all age groups [2].

Many associated risk factors that increase the complications of diabetes are smoking, obesity, alcohol consumption, and high BP and cholesterol and junk diets. ESRD and deterioration of the kidney is the associated risk factor of diabetes and may lead to kidney failure with reduced levels of glomerular function which in turn causes the levels of urea and "serum creatinine" to increase rapidly [3]. Studies have shown that about 30-40% of the diabetic people have developed renal abnormality and even kidney failure all due to diabetes [3, 4].

The main reason of diabetic deterioration of the kidney is due to the glycosylation of tissue protein. This collection of advanced glycosylated end-products by association with collagen leads to renal and vascular complications [5]. The only way to control the risk of diabetic deterioration of the kidney is by maintaining a good glycemic level [6]. The early detection can be done by observing for microalbuminuria, reduced GFR and a rapid increase in levels of creatinine and urea [7, 8]. The aim of this study is to correlate the levels of urea and serum creatinine with glycemic index and diabetes duration in type-1 DM and type-2 DM.

Materials and Methods

Study Population and Location: A total of 288 participants with 144 patients in both the groups (diabetic and non-diabetic groups) were selected from a tertiary care center. The time period of this study was December 2021 to November 2022.

Inclusion and Exclusion criteria: As for the diabetic group, among the 144 patients all the participants were male with the age of 35-55 years affected with both types of diabetes. As for the non-diabetic group, the participants were picked out from the whole population and were taken as a control group. Personal consent was taken from every individual followed by a thorough examination. The exclusion criteria were the participants with known renal disease.

Data Collection and Analysis: A complete examination was done on the following parameters like (i) Age was calculated from the day of birth, (ii) Height of the individual was calculated in centimeters, (iii) Body weight of the individual was measured in kilograms, (iv) body mass index of the individuals was derived by dividing the weight in kg to the height in m^2. All the biochemical tests were performed in biochemical laboratories. The blood sugar levels of both the patients and control groups were analyzed for post and pre meal levels. The normal range of creatinine was 0.7-1.5 mg/dL and the normal range of urea 11-46 mg/dL.

Statistical Analysis: The Hemoglobin A1c for all the patients was calculated by ion exchange resin method and for all the derived values calculation of mean and standard deviation were done. Corrections of the levels of urea and serum creatinine with Hemoglobin A1c and diabetes duration illness in diabetic patients were observed by "Pearson's coefficient correlation".

Results

All the parameters in control groups (participants with no diabetes), Type 1 DM also called as insulin dependent diabetes (IDDM) and Type 2 DM also called as non- insulin dependent diabetes (NIDDM) were given in Table 1 with mean ± Standard deviation.

Table 1: Comparison among study groups for anthropometric parameters

Parameters	Groups	N	Mean±SD	Median	Inter quartile range	F value	P value
Age in years	Control	144	48.20±6.62	49.00	11.00	1.595	0.327
	NIDDM	144	48.64±5.78	49.00	9.00		
	IDDM	144	47.11±6.89	46.00	11.00		
Height in cm	Control	144	162.67±7.38	164.00	8.00	0.895	0.553
	NIDDM	144	162.21±6.94	163.00	10.00		
	IDDM	144	161.31±8.37	163.00	10.75		
Weight in kg	Control	144	56.64±4.87	57.00	7.75	1.703	0.304
	NIDDM	144	56.17±7.99	57.00	9.00		
	IDDM	144	54.96±6.44	56.00	7.75		
BMI kg/m^2	Control	144	21.74±3.27	22.19	4.56	2.600	0.184
	NIDDM	144	21.75±4.30	22.66	5.48		
	IDDM	144	20.84±3.78	21.52	4.54		

The blood sugar levels of pre and post meal (FBS and PBS), the levels of Hemoglobin A1c of the control group, Type 1 DM and Type 2 DM group are listed in Table 2. A notable increase in the blood sugar levels of pre and post meal were observed in both the types of diabetic patients than the control group. The Hemoglobin A1c levels were also increased in both the types of diabetic patients than the control group; particularly greater values were observed in type-1 diabetics patients.

Table 2: Comparison among study groups for the level of FBS, PBS and Hemoglobin A1c

Parameters	Groups	Mean±SD	Median	Inter quartile range	F value	P value
FBS (mg/dL)	Control	83.89±7.50	87.00	6.10	47.395	0.000
	NIDDM	97.64±12.50	97.00	12.10		
	IDDM	87.68±8.80	89.00	7.60		
PBS (mg/dL)	Control	128.93±10.85	129.00	9.10	127.298	0.000
	NIDDM	172.42±15.60	173.00	25.10		
	IDDM	163.85±34.45	170.00	49.10		
Hemoglobin A1c (%)	Control	5.21±1.30	5.20	0.58	3.507	0.035
	NIDDM	6.72±0.13	5.90	0.70		
	IDDM	5.88±0.42	6.00	0.68		

Discussion

The predominant cause of death rates and the occurrence of disease are very usual in diabetes. A very common associated risk factor in diabetes is "nephropathy" which is termed as renal failure that affects the diabetic patients in a very large proportion. Studies have suggested that greater the duration of diabetes in patients have resulted in many associated complications mainly renal failure followed by heart risks and ulcers in feet [9, 10].

Both the types of diabetic patients are known to get affected with diabetic kidney failure however the reason of the disease may vary in patients. Type-1 diabetes patients are more predominant to diabetic kidney failure when compared to type-2 diabetic patients. Many researches have been done and suggested that the main reason for the occurrence of diabetic nephropathy is due to the elongated duration of diabetes in patients [11, 12].

But there are only a few reports available on correction of serum urea and creatinine which stands as a biomarker for renal disease. "Diabetic nephropathy" is the key symptom of kidney failure globally and may lead to lifetime dialysis and so initial examinations are meant to be suggested for every diabetic patient in order to lower the chances of their associated complications.

More convenient initial tests like the levels of urea and serum creatinine with the analysis of hemoglobin A1c will always be helpful for the diabetic patients to quickly detect the risk factors in a timely manner [13]. There was a notable increase in levels of blood sugar post and pre meal conditions in both types of diabetes patients when compared with the control groups with a significant increase in type 1 DM patients particularly [14].

Pearson's correlation coefficient was used to correlate the levels of "serum creatinine and urea" with the elongated diabetes duration and the level of hemoglobin A1c. The current study showed the correlation of "serum creatinine and urea" with the levels of hemoglobin A1c in only type 1 DM patients.

In Type 2 DM patients no correlation of both the serums were observed with duration of diabetes. However, the longer duration of the disease decreases the renal function of the individual which in turn increases the levels of urea and serum creatinine thereby allowing the kidney to accumulate wastes and hence the increase in both the serums are only due to impaired function of kidney and an increase in blood sugar levels leads to decreased kidney function [15-17]. Since the elevated serum levels of creatinine and urea cannot be treated and can cause permanent damage but the elevated level of hemoglobin A1c can be treated by primary methods [18]. So, the differing levels of "serum urea and creatinine" are due to glomerular changes which are permanent so the only step to deviate this glomerular change is the early detection through estimating the levels of "serum creatinine and urea" [19, 20,21].

Conclusion

In Type 1 diabetic patients, an increased level of hemoglobin A1c was observed with a strong relationship with the levels of serum creatinine and urea. A high suggestion must be made with diabetic patients to analyze the levels of serum creatinine and urea with hemoglobin A1c. Therefore, serum creatinine and urea are strong biological markers and stand as an initial detecting test in order to assess the kidney function in diabetic patients.

References

1. Kaveeshwar SA, Cornwall J. The current state of diabetes mellitus in India. Australas Med J. 2014;7(1):45-8.
2. Evans TC, Capell P. Diabetic nephropathy. Clin Diabetes. 2000;18(1). Available from: http://www.journal.diabetes.org/ clinicaldiabetes/v18n12000/Pg7.htm. [Last accessed on 2017 Mar 24].
3. Gonzalez Suarez ML, Thomas DB, Barisoni L, Fornoni A. Diabetic nephropathy: Is it time yet for routine kidney biopsy? World J Diabetes. 2013; 4(6):245-55.
4. Berthelot M. Berthelot's reaction mechanism. Rep Chim Appl. 1859;6:284.
5. Owen JA, Iggo B, Scandrett FJ, Stewart CP. The determination of creatinine in plasma or serum, and in urine; a critical examination. Biochem J. 1954;58(3):426-37.
6. Adler AI, Stevens RJ, Manley SE, Bilous RW, Cull CA, Holman RR; UKPDS GROUP. Development and progression of nephropathy in Type 2 diabetes: The United Kingdom Prospective Diabetes Study (UKPDS 64). Kidney Int. 2003;63(1):225-32.
7. Nathan DM, Singer DE, Hurxthal K, Goodson JD. The clinical information value of the glycosylated haemoglobin assay. N Engl J Med. 1984;310:341-6.
8. Teitz NM, Trunder P. Estimation of blood glucose. Clinical Guide to Laboratory Test. Philadelphia, PA: WB Sanders; 1976. p. 238.
9. Ruggenenti P, Remuzzi G. Nephropathy of Type 1 and Type 2 diabetes: Diverse pathophysiology, same treatment? Nephrol Dial Transplant. 2000;15:1900-2.
10. Chakdoufi , S., Moumen, A., & Guerboub, A. (2023). Dyslipidemia and Diabetic Retinopathy in Moroccans Type 2 Diabetics Patients: A Cross-Sectional Study. Journal of Medical Research and Health Sciences, 6(3),2471–2479. https://doi.org/10.52845/JMRHS/2023-6-3-1

11. Krolewski AS, Warram JH, Christlieb AR, Busick EJ, Kahn CR. The changing natural history of nephropathy in Type I diabetes. Am J Med. 1985;78(5):785-94.
12. Cowie CC, Port FK, Wolfe RA, Savage PJ, Moll PP, Hawthorne VM. Disparities in incidence of diabetic end-stage renal disease according to race and type of diabetes. N Engl J
1. Med. 1989;321(16):1074-9.
13. Inassi J, Vijayalakshmy R. Role of duration of diabetes in the development of nephropathy in Type 2 diabetic patients. Natl J Med Res. 201 3;1(2):5-8.
14. Mandal FK, Jyothrimayi D. Comparative study of microalbuminuria and glycated hemoglobin levels in Type 2 diabetic complications. Asian J Pharm Clin Res. 2016;8(2):356-60.
15. Singh P, Khan S, Mittal RK. Glycemic status and renal function among Type 2 diabetics. Bangladesh J Med Sci. 2014;13(4):406-10.
16. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care. 2009;32 Suppl 1:S63-7.
17. Bamanikar SA, Bamanikar AA, Arora A. Study of serum urea and creatinine in diabetic and non-diabetic patients in in a tertiary teaching hospital. J Med Res. 2016;2(1):12-5.
18. Sharma A, Hirulkar NB, Wadel P, Das P. Influence of hyperglycemia on renal function parameters in patients with diabetes mellitus. Int J Pharm Biol Arch. 2011;2(2):734-9.
19. Mohan V, Shah S, Saboo B. Current glycemic status and diabetes related complications among Type 2 diabetes patients in India: Data from the achieve study. J Assoc Physicians India. 2013;61 Suppl 1:12-5.
20. Unnikrishnan RI, Rema M, Pradeep R, Deepa M, Shanthirani CS, Deepa R, et al. Prevalence and risk factor of diabetic nephropathy in an urban South Indian population; The Chennai urban rural epidemiology study (CurES-45). Diabetes Care. 2007;30:2019-24.
21. Ziyadeh FN. Different roles for TGF-β and VEGF in the pathogenesis of the cardinal features of diabetic nephropathy. Diabetes Res Clin Pract. 2008;82 Suppl 1:38-41.