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Assessment of Renal Function, in Diabetic Patients Compared to those without Diabetes in a Cameroonian Population

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Abstract

Background: Diabetes is a metabolic disease that affects several organs including the kidneys. It is a major public health problem and the leading cause of kidney failure worldwide. Early management of diabetes with strict control of blood glucose levels reduces microalbuminuria and progression to diabetic nephropathy. The aim of this study was to compare the glomerular filtration rate of two groups of diabetic patients: those under medical supervision and those who are not under supervision and taking no treatment with normal individuals.

Methods: A case-control study was conducted from June to August 2015 at the Cité Verte District Hospital. Socio-demographic data were collected using a questionnaire, followed by blood tests for urea/creatinine, urine sampling for glycosuria and proteinuria for each eligible participant. The data were analysed using SPSS version 20.0 software, with a significant P value at P>0.05. Glomerular filtration rate was calculated using the Modification of Diet with Renal Disease (MDRD) formula.

Results: The sample consisted of 99 participants, distributed as follows: 36.4% were diabetics under treatment and medically monitored, 32.3% were naïve diabetics not medically monitored and 31.3% were healthy patients. The majority of the patients were women (69.7%), with a mean age of 47.86 ±16.32 years. The parameters of renal function evaluation, showed that the mean uremia (1.15±4.17 g/l), and creatinemia (13.22±6.77 mg/l) were significantly higher in naive diabetics (p<0.05) compared to the other two subgroups. No significant differences were observed for proteinuria and glycosuria in the different subgroups. The glomerular filtration rate was significantly lower in the diabetic naïve group (65.88±23.19 ml/min/1.73m^2). In the diabetic population, the independent risk factors for impaired glomerular filtration rate were age > 50 years (OR=1.53; 95% CI: 0.43-5.49); no treatment (OR= 27.2; 95% CI: 3.31-223.84); hyper-creatinemia (OR=26.40; 95% CI: 6.07-114.7); hyper-uremia (OR= 8.16; 95% CI: 1.91-34.85).

Conclusion: Although diabetic patients are predisposed to nephropathy, it should be noted that medical management, including therapeutic and dietary follow-up, improves the metabolic health of these patients and slows the development of long-term complications.

Keywords: Diabetes; Diabetic nephropathy; Glomerular filtration rate; Medical follow-up

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Introduction

Diabetes mellitus is a metabolic disease characterised by hyperglycaemia due to defects in insulin secretion, insulin action, or both. It affects approximately 422 million people worldwide, the majority of whom live in low and middle-income countries, and is directly responsible for 1.6 million deaths each year. In recent decades, the number of cases and the prevalence of diabetes have been steadily increasing [1]. Africa has the lowest prevalence of diabetes (4.2%) compared to other continents, but the prevalence and burden of the disease is increasing rapidly in Africa [2]. The prevalence of diabetes in Cameroon was estimated to be around 6% in 2018 [3]. The chronic hyperglycaemia associated with this condition causes a lot of damages and long term defects, leading to the development of other non-communicable diseases and micro/macro-vascular changes in various organs, of which the kidney is one of them [4]. Diabetes is the leading cause of end-stage renal disease (ESRD) worldwide, with approximately 40-60% of people with type 2 diabetes developing diabetic nephropathy (DN) after 10-15 years of diabetes progression [5,6]. In addition, diabetic complications are more common in underdeveloped countries due to lack of screening tools, early diagnosis and access to health care, resulting in a rapid onset of problems associated with this disease [6,7]. Diabetic nephropathy is one of the major complications of diabetes; however, data on this important connectedness are limited in sub-Saharan Africa (SSA). Effective management of diabetes and early diagnosis of diabetic nephropathy can delay progression to chronic kidney disease [5]. A study by Adebamowo and collaborators in 2016 on the impact of type 2 diabetes on renal function impairment in sub-Saharan African populations showed that type 2 diabetes was associated with a 50% increased risk of renal function impairment in this sample of sub-Saharan African adults [8]. In Ethiopia, a study conducted by Taderegew in 2020 on the assessment of renal failure using estimated glomerular filtration rate in patients with type 2 diabetes showed that renal failure was prevalent in patients with type 2 diabetes. Older age, female sex, duration of diabetes, hypertension, poor glycaemic control and BMI (body mass index) were significantly associated with renal failure [6]. Several authors have worked on diabetes in Cameroon, but few studies have focused on diabetic nephropathy, however, a study that aimed to determine the prevalence and biomarkers of diabetic nephropathy (DKD) in diabetic patients undergoing treatment in Buea and Ngaoundéré in Cameroon found a significant association between diabetic nephropathy and two variables: female sex and hypercreatinemia [9]. Because of the high prevalence of diabetes and kidney disease in Cameroon, it was necessary to conduct this research to compare glomerular filtration rate in medically monitored diabetic patients, those not monitored and healthy individuals.

Methods

This case-control study; took place from June to August 2015 at the Cité Verte District Hospital. A total of 99 patients were recruited between 8am and 12pm from Monday to Friday into the study. The latter was approved by the Faculty of Sciences (Department of Biomedical Sciences) of the University of Ngaoundéré, permitting our team to go the field; and by the Director of Cité Verte District Hospital, permitting us to start the survey. In addition, all participants in the survey signed an informed consent form after a brief presentation of the study's objective and benefits. The study included all known diabetic patients not taking any treatment and not under the care of a physician, who were considered cases, and diabetic patients under treatment and regularly followed up at the Cité Verte District Hospital; as well as healthy people (non-diabetic and without any pathology affecting renal function) who were considered controls. Patients had to be between 20 and 65 years of age and that must have signed the consent form. Patients over 65 years of age were not included because with age there is a decrease in glomerular filtration rate. Of the total of 99 patients recruited, 36 were diabetic patients under treatment, 32 diabetic patients not taking any treatment (naive), and 31 healthy patients suffering neither from diabetes nor from pathologies that could influence renal function. The data collection form (questionnaire) was used to identify patients meeting the inclusion criteria and was completed by each study participant under the supervision of the investigator. The questionnaire contained information on socio-demographic characteristics (sex, age, place of residence and occupation of the participants) and duration of the disease. After completing the questionnaire, blood pressure was measured with an electric blood pressure monitor on the participant's left arm in a sitting position after at least 10 minutes of rest, followed by blood and urine sampling. A volume of 5 ml of venous blood was collected after one night of fasting (8-10h) from all participants. These samples were sent to the laboratory, centrifuged and the serum was used to determine serum urea and creatinine. The determination of blood urea was carried out using the BIOLABO kit, by the enzymatic and colorimetric method based on the specific action of urease which hydrolyses urea into carbonate and ammonium ions. The ammonium ions then form a blue-green coloured complex with the chlorine salicylate. The intensity of the colouration is proportional to the concentration of urea in the sample and is measured at 600 nm [10]. The determination of serum creatinine was carried out using the kinetic two-point colorimetric method based on the Jaffé reaction. The method consists of measuring the intensity of the colouration of the red-orange complex formed by creatinine and picric acid in alkaline medium at 510 nm; the rate of colour formation is proportional to the concentration of creatinine in the sample [11]. These two parameters were used to explore renal function.

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20-30 ml of urine sample was collected after blood collection by each participant in a dry, sterile jar. They were asked to collect the urine in the middle of the stream. Qualitative and semi-quantitative analyses of glycosuria and proteinuria on urine reagent strips were performed. Glomerular filtration rate (GFR) is the volume of plasma filtered by the kidneys per unit time. This was estimated using the Modification of Diet in Renal Disease (MDRD) formula as follows: GFR =186×SCr (mg/dl)-1.154 × age (years)-0.203 × 0.742 (if female) × 1.210 (as our population was African), (SCr is serum creatinine) (12). We calculated it automatically from the eGFR calculator software. Normal glomerular filtration rate is between 90-120 ml/min/1.73m^2 and a GFR < 60 ml/min/1.73m^2 is considered pathological according to the National Foundation of Kidney Disease.

Data processing and analysis

Data were entered using Epi-info software and, after verification, exported to SPSS (IBM SPSS Statistics for Macintosh, Version 20.0. Armonk, NY) for analysis. Quantitative data were expressed as mean and standard deviation (X ± SD) and categorical variables were presented as frequency (N) and percentage (%). The chi-square test was used to compare biochemical and clinical parameters of diabetic patients according to the duration of the disease; and the ANOVA test was used to determine the differences between the means of the different subgroups. The bivariate logistic regression model was used to determine the independent risk factors for GFR impairment in diabetic patients. The degree of association was expressed using the odds ratio (OR) and 95% CI. P value of less than 0.05 was considered statistically significant.

Results

Table 1 shows that of the 99 participants recruited, 36 (36.4%) diabetics under treatment, 32 (32.3%) were treatment-naive diabetics while 31 (31.3%) were healthy individuals. Our population was predominantly female that is 69.7% female versus 30.3% male, 53, 5% of participants were ≤ 50 years old and 46.5% were > 50 years old. According to marital status, married participants were the most represented (54.5%), while 82.8% of participants lived in urban areas and only 17.2% lived in rural areas. Table 2 shows that the mean age is almost similar in diabetic patients (treatment and naive) while healthy patients were younger (30 ± 11.89). The difference in age was significant. Regarding the biochemical parameters, the mean uremia and creatinemia were higher in the diabetic naive patients (1.15 ± 4.17g/l and 13.22 ± 6.75mg/l respectively) compared to the other two groups, healthy and treatment patients. The difference was statically significant (p<0.05). No significant difference was observed for proteinuria and glucosuria in the different groups. The mean glomerular filtration rate was significantly lower in naive diabetic patients (65.88 ± 23.19 ml/min/1.73m^2) than in the other two groups in where the mean GFR was 86.50 ± 20.63 ml/min/1.73m2 for diabetic patients on treatment and 103.19 ± 22.9 ml/min/1.73m^2 for healthy patients, respectively. Table 3 presents the biochemical and clinical characteristics of diabetic patients according to the duration of the disease. It is noted that all naive patients had a disease duration of <10 years while 69.4% of the patients on treatment had a disease duration of ≥10 years. Patients with disease duration ≥ 10 years were less proned to albuminuria, glycosuria, hyper uremia and hyper creatinemia. They equally had a good estimate of glomerular filtration rate compared to those with < 10 years duration. The difference is significant (P < 0.05). There is an increase in systolic and diastolic blood pressure of 84% and 40%, respectively for patients with disease duration ≥ 10 years,. The difference was significant for systolic blood pressure. Table 4 shows that in diabetic patients, age group of > 50 years (OR=1.53; 95% CI: 0.43-5.49); no treatment (OR=27.2; 95% CI: 3.31-223.84); hyper-creatinemia (OR=26.40; 95% CI: 6.07-114.7); hyper-uremia (OR=8.16; 95% CI: 1.91-34.85); were independent risk factors for impaired glomerular filtration rate.

Table 1: Socio-demographic characteristics of the study participants

Variables	Categories	Frequencies (N =99)	Percentages (%)
Sex	Female	69	69.7
	Male	30	30.3
Age (years)	≤ 50	53	53.5
	> 50	46	46.5
Marital status	Single	25	25.3
	Married	54	54.5
	Widowed	19	19.2
Employment status	House wife	40	40.4
	Farmer	7	7.1
	Student	11	11.1
	employee	24	24.2
	Daily laborer	10	10.1
	Retired	7	7.1
Residence	Rural	17	17.2
	Urban	82	82.8
Category of participants	On treatment	36	36.4
	Naïve	32	32.3
	Healthy participant	31	31.3

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Table 2: Comparison of biochemical parameters in relation to glomerular filtration rate in the different participant subgroups

Variables	Category of participant			P value
	Naïve	On treatment	Healthy patient	
Age (years)	55.69±11.07	55.50±12.04	30±11.89	0.001
Creatinemia (mg/l)	13.22±6.75	9.58±2.06	9.06±1.67	0.001
Uremia (g/l)	1.15±4.17	0.36±0.15	0.21±0.10	0
eDFG (ml/min/1.73 m^2)	65.88±23.19	86.50±20.63	103.19±22.9	0
Glucosuria	6 (18.8)	7 (19.4)	2 (6.51)	0.132
albuminuria	11 (34.4)	13 (36.1)	7 (22.6)	0.222

Table 3: Clinical and biochemical characteristics of diabetic patients according to the age of the disease.

Variables	Duration of disease		P value
	< 10 years	≥ 10 years	
Naïve patients	32 (100)	00(00)	0.001*
On treatment	11 (30.6)	25 (69.4)	
Hyper-Albuminuria (mg/dl)	16 (37.2)	8 (32.0)	0.332
Hyper-Glucosuria (mg/dl)	11 (25.6)	2 (8.0)	0.037*
Hyper-Uremia (g/l)	9 (20.9)	1 (4.0)	0.028*
Hyper-Créatinemia (mg/l)	14 (36.2)	2 (8.0)	0.010*
Low GFR (ml/min/1.73m^2)	15 (34.9)	0 (00)	0.001*
High Systolic blood pressure (mmHg)	25 (58.1)	21 (84.0)	0.014*
High Diastolic blood Pressure (mmHg)	13 (30.2)	10 (40.0)	0.206

Low DFG <60 ml/ min/1.73m^2

Table 4: Independent risk factors for GFR impairment in patients with diabetes.

Predictor of impaired GFR		OR (95% CI)	P value
Age	≤ 50	1	0.509
	> 50	1.53 (0.43-5.49)	
Sex	Woman	1	0.37
	Man	0.52 (0.13-2.12)	
Systolic blood pressure	Normal	1	0.475
	High	0.64 (0.19-2.12)	
Diastolic blood Pressure	Normal	1	0.509
	High	0.65 (0.18-2.32)	
Diabetic patient	On treatment	1	0.002*
	Naïve	27.2 (3.31-223.84)	
Creatinemia	Normal	1	0.001*
	High	26.40 (6.07-114.7)	
Uremia	Normal	1	0.005*
	High	8.16 (1.91-34.85)	
Albuminuria	Normal	1	0.333
	High	0.54 (0.16-1.73)	
Glucosuria	Normal	1	0.194
	High	0.24 (0.02-2.05)	

*GFR: Glomerular Filtration Rate; OR: Odd Ratio; CI: Confidence Interval

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Discussion

The study was aimed at comparing glomerular filtration rate in medically monitored diabetic patients, to those who were medically monitored and non-diabetics. Diabetic nephropathy is a major cause of chronic failure worldwide, so assessment of renal function is important in diabetics [13]. Urea and creatinine are useful prognostic markers and predictors of kidney damage in diabetic patients. The results of this study show that for renal function parameters, urea and creatinine are normal in the healthy group and in the subgroup of diabetic patients on treatment and high in diabetic naïve patients, the difference being statistically significant ($p<0.05$) (table 2). These results are in agreement with those of Amartey et al. who obtained mean values of 87.09±41.91 µmol/l (9.9±4.76 mg/l) for creatinemia and 4.40±2.05 mmol/l (0.17±0.08 g/l) for uremia in a diabetic population followed up at the clinical laboratory in Ghana. These hypercreatinemia and hyperuremia observed in naive diabetic patients showed that the renal excretion rate of urea and creatinine is low in these patients. It is known that 90% of urea is excreted by the kidneys and 10% by the intestinal tract and skin, while creatinine is completely excreted by the kidneys. An increase in the blood level of both parameters is a sign of renal failure [14]. Glycosuria and albuminuria are also parameters for the exploration of renal function; these parameters indicate the presence of detectable glucose and albumin in the urine. Physiologically, glucose is exclusively reabsorbed by the proximal tubule through appropriate transporters, glycosuria occurs when the threshold of renal reabsorption is exceeded (1.80 g/l). The same is true for albumin which is totally reabsorbed at the glomerular capillary wall [15,16]. In our study, these two parameters were not statically significant. Treated and naive diabetic patients had almost the same percentages (table 2). A study by Wiwanikit in 2007 showed that prolonged glucosuria, subsequently leads to glomerular damage with reduced pore size and finally to albuminuria which is a late complication. Estimation of glomerular filtration rate (eGFR) is the best indicator for measuring the level of renal function and determining the stage of renal disease. It is essential in diabetic patients, as diabetes is a known risk factor for kidney disease [17]. In our study, eGFR was assessed in type 2 diabetic patients and healthy patients using the MDRD equation. In this study, the mean glomerular filtration rate in the different subgroups was above 60 ml/min/1.73m^2 ; although in the naive patients there was a more pronounced decrease in GFR. According to the National Kidney Foundation (2015), a GFR below 60 for three months or more or a GFR above 60 with kidney damage (marked by high levels of albumin in the urine) indicates chronic kidney disease and GFR between 89-60 ml/min/1.73m2 explains a mild loss of renal function. Uncontrolled diabetes has serious consequences for health and well-being, hence the importance of medical follow-up. Our study showed that all diabetic patients not followed up, had a disease duration of <10 years, and all patients with disease duration of ≥ 10 years were followed up and had better biochemical parameters. This shows that regular follow-up is essential to prevent complications and their aggravation. The objective of treatment and dietary follow-up is to maintain an optimal glycaemic balance hence the importance of medical follow-up. Indeed, poor glycaemic control in diabetic patients leads to the development and progression of diabetic nephropathy, which will result in the deregulation of various biochemical pathways with an increase in reactive oxygen species, activation of protein kinase C, and increased production of advanced glycation end products [18]. Hypertension is usually associated with diabetes, and its prevalence depends on disease duration, age, sex, history of glycaemic control and the presence of renal disease, among other factors [19]. The systolic blood pressure of our patients were significantly higher in those with disease duration of ≥ 10 years, this is in agreement with several studies that have shown that increased duration of type 2 diabetes is associated with an increased prevalence of hypertension [4,20,21]. Diabetic nephropathy is a type of kidney disease caused by diabetes. It has been shown that diabetic patients with common risk factors such as hypertension, poor glycaemic control, smoking, obesity and hyperlipidaemia are more likely to develop diabetic complications [22]. For this study, the independent risk factors for impaired glomerular filtration rate were age > 50 years, lack of medical follow-up, hypercreatinemia and hyperuremia. The loss of renal function as a result of aging has been known for decades, with most studies showing that advanced age is an independent predictor of impaired glomerular filtration rate [8,23]. It is hypothesised that the increase in cellular oxidative stress associated with ageing leads to endothelial cell dysfunction and changes in vasoactive mediators, resulting in increased atherosclerosis, hypertension and glomerulosclerosis [24]. With regard to hypercreatinemia, our results are consistent with a study conducted in a Cameroonian population by Ibrahim et al. who also found that hypercreatinemia was a risk factor for decreased renal filtration rate [9]. These results suggest that diabetes may be linked to chronic kidney disease (CKD) even in the absence of proteinuria.

Conclusion

In conclusion, our study showed that diabetic patients not under medical supervision were subject to a more rapid loss of kidney function than diabetic patients treated and supervised by health professionals. Prevention, early and adequate management are solutions to avoid the occurrence of complications in people with diabetes. This study remains preliminary and superficial, and therefore recommends further in-depth studies. Another study with improved sample size and dietary habits taken into account is also recommended.

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List of abbreviations

DN : Diabetic Nephropathy

CKD: Chronic Kidney Disease

ESRD : End-Stage Renal Disease

eGFR: estimated Glomerular filtration rate

GFR: Glomerular filtration rate

MRDR : Modification of Diet in Renal Disease

SSA : Sub-Saharan Africa

SPSS: Statistical Package for the Social Sciences

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Availability of data and materials

The data and the study's material are available to all from the authors upon request.

Authors'contributions

CSMB was involved in designing the project, wrote and revised the article draft, and analyzed the data; **HTD** assisted with data analysis and revised the article, **AANA** participated in the design of the project and read the article, **RHH** read and reviewed the article, **CET** participated in the data collection, **SSB** participated in the data collection, **CT** supervised the work. All authors read and approved the final manuscript.

Competing interest

The authors declare that they have no competing interests

Ethics approval and consent to participate

The protocol for this study was approved by the Faculty of Sciences of the University of Ngaoundéré and a research certificate was issued (N°2015/042/UN/DFS/CD-SBM), the study was also approved by the Director of the District Hospital of CITE VERTE who issued us a research authorization (N°0000186/MINSANTE/DRC/DSCV/HDCV). Written informed consent was obtained from all of the participants prior to participation in the study.

References

1. OMS | Diabète. WHO. World Health Organization (2020).
2. Mbanya JCN, Motala AA, Sobngwi E, et al. Diabetes in sub-Saharan Africa. The Lancet 375 (2010): 2254-2266.
3. Simeni Njonnou SR, Boombhi J, Etoa Etoga MC, et al. Prevalence of Diabetes and Associated Risk Factors among a Group of Prisoners in the Yaoundé Central Prison. Journal of Diabetes Research 25 (2020): e5016327.
4. Mariye ZT, Bahrey TD, Tasew AH, et al. Determinants of Diabetic Nephropathy among Diabetic Patients in General Public Hospitals of Tigray, Ethiopia, 2018/19. International Journal of Endocrinology 21 (2020): e6396483.
5. Hamat I, Abderraman GM, Cisse MM, et al. Profil de la néphropathie diabétique à l'Hôpital Général de Référence Nationale de N'Djamena (Tchad). Pan Afr Med J (2016): 36.
6. Taderegew MM. Assessment of renal impairment using estimated glomerular filtration rate among type 2 diabetes mellitus patients in North-East Ethiopia: a cross-sectional study. J Diabetes Metab Disord 19 (2020): 1473-1481.
7. Pereira O, Cerejo D, Parjoie R, et al. Analyse de la qualité de la prise en charge médicale des patients diabétiques. Sante Publique 25 (2013): 77-86.
8. Adebamowo SN, Adeyemo AA, Tekola-Ayele F, et al. Impact of Type 2 Diabetes on Impaired Kidney Function in Sub-Saharan African Populations. Front Endocrinol 7 (2016): 50.
9. Ibrahim MMK, Acha AE, Shey ND, et al. Prevalence and Biomarkers of Diabetic Kidney Disease in Diabetic Patients on Treatment in Buea and Ngaoundere, Cameroon. American Journal of Bioscience and Bioengineering 8 (2020): 84.
10. Tiffany TO, Jansen JM, Burtis CA, et al. Enzymatic kinetic rate and end-point analyses of substrate, by use of a GeMSAEC fast analyzer. Clin Chem. août 18 (1972): 829-840.
11. Labbé D, Vassault A, Cherruau B, et al. Method selected for the determination of creatinine in plasma or serum. Choice of optimal conditions of measurement. Ann Biol Clin 54 (1996): 285-298.
12. Levey SA, Bosch JP, Breyer LJ, et al. A more accurate method to estimate glomerular filtration rate from serum creatinine: A new prediction equation. Annals of Internal Medicine 16 (1999): 968.
13. Fontela PC, Winkelmann ER, Ott JN, et al. Estimated glomerular filtration rate in patients with type 2 diabetes mellitus. Rev Assoc Med Bras 60 (2014): 531-537.
14. Amartey NAA, Nsiah K, Mensah FO. Plasma Levels of Uric Acid, Urea and Creatinine in Diabetics Who Visit the Clinical Analysis Laboratory (CAn-Lab) at Kwame

Bilongo CSM, et al., J Food Sci Nutr Res 2023
DOI:10.26502/jfsnr.2642-110000133

Nkrumah University of Science and Technology, Kumasi, Ghana. J Clin Diagn Res 9 (2015): 5-9.

15. Hung CC, Lin HYH, Lee JJ, et al. Glycosuria and Renal Outcomes in Patients with Nondiabetic Advanced Chronic Kidney Disease. Sci Rep 6 (2016): 39372.
16. Wiwanitkit V. Glucosuria and albuminuria in diabetic nephropathy: a consideration at nanolevel. J Diabetes Complications 21 (2007): 164-165.
17. Bjornstad P, Karger AB, Maahs DM. Measured GFR in Routine Clinical Practice - The Promise of Dried Blood Spots. Adv Chronic Kidney Dis 25 (2018): 76-83.
18. Prischl F, Wanner C. Renal Outcomes of Antidiabetic Treatment Options for Type 2 Diabetes- A Proposed MARE Definition (2018).
19. Boer IH, Bangalore S, Benetos A, et al. Diabetes and Hypertension: A Position Statement by the American Diabetes Association. Dia Care 40 (2017): 1273-1284.
20. Akalu Y, Belsti Y. Hypertension and its associated factors among type 2 diabetes mellitus patients at Debre Tabor general hospital, Northwest Ethiopia. Diabetes Metab Syndr Obes 13 (2020): 1621-1631.
21. Mansour AA. Prevalence and control of hypertension in iraqi diabetic patients: a prospective cohort study. Open Cardiovasc Med J 6 (2012): 68-71.
22. Dabla PK. Renal function in diabetic nephropathy. World J Diabetes 1 (2010): 48-56.
23. Zoppini G, Targher G, Chonchol M, et al. Predictors of estimated GFR decline in patients with type 2 diabetes and preserved kidney function. Clin J Am Soc Nephrol 7 (2012): 401-408.
24. Weinstein JR, Anderson S. The aging kidney: Physiological changes. Adv Chronic Kidney Dis 17 (2010): 302-307.

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