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Prevalence of Chronic Kidney Disease and dyslipidaemia in diabetic patients in Buea, South-West of Cameroon

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Abstract: -

Introduction: Chronic Kidney Disease (CKD) is a major complication of diabetes worldwide. Diabetic condition can be also complicated by diabetic dyslipidemia. The prevalence of CKD Cameroon, Africa or in other parts of the world of diabetics is not clearly estimated but, some studies tried to estimate prevalences in local areas or isolated zones. In addition, assessment of both prevelances of CKD and diabetic dyslipidaemia are not well documented. The present study is aimed at estimating the prevalence of CKD and diabetic dyslipidaemia in diabetic patients in Buea, Cameroon. **Methodology:** This was a cross-section study conducted at the diabetic clinic of Buea Regional Hospital and the Lambe Foundation for diabetes and hypertension in Buea, South-West Region of Cameroon. **Result and Discussion:** Out of 120 diabetics enrolled, 63.33% were females. 53.33% were hypertensive, 74.16% overweight and obese and, 32.50% presented real obesity. The mean of eGFR was 92.76 ml/min/1.73m^2 and, woman presented the lower value (89.55±43.49ml/min/1.73m^2) compared to men (98.37±87.43 ml/min/1.73m^2) (X^2= 0.107; P = 0.466). The prevalence of CKD was 70.83% and the stage 2 was the high prevalent (36.60%). 20.83% presented CKD from stage 3 to 5. The prevalence of micro-albuminuria was 30% and macro-albuminuria was prevalent at 3.33%. Diabetic dyslipidaemia affected about half of the study population with a prevalence of 48.9%. The co-affection micro-albuminuria and diabetic dyslipidaemia was observed in 16.66% of the population individuals, against 2.50% for the co-affection macro-albuminuria and diabetic dyslipidaemia. The prevalence of diabetic dyslipidaemia among diabetic with CKD was 39.16% (X^2=0.118).

Conclusion: This study shown the high prevalence of CKD in diabetics and, was the first to assess the prevalences of both CKD and diabetic dyslipidaemia in diabetic Cameroonians. The findings advice on the assessment of the complications of diabetes in Cameroon in order to estimate, in more large population, risk factors and pattern of diabetic dyslipidaemia and CKD in diabetic Cameroonian.

Keywords: - CKD, diabetic dyslipidaemia, diabetes, Cameroon, Prevalence.

Introduction:

Chronic Kidney Disease (CKD) is a major common complication of diabetes which represents a major medical and economic concern. According to the KDIGO guideline, CKD is divided into 5 main stages which go from 1 to 5. The stage 3 has 2 sub-stages named stage 3a and 3b. The stage 5 is the last and dangerous stage and it is called End-Stage of Renal Disease (ESRD) [1, 2]. The installation of CKD is slow, silent and progressive. In diabetic condition, the development of CKD is done via the overproduction, deposition and or activation and up-regulation of extracellular matrix, advanced glycation end products, reactive oxygen species, protein kinase C, transforming growth factor-beta 1(TGF-β1) and renine-angiotensine system [3, 4]. Other additional factors are implicated in the development of CKD in diabetics like obesity and overproduction of pro-inflammatory factors. These two for example are implicated in the hyper glomerular-filtration due to the reduction of the resistance of afferent and efferent glomerular arterioles, in consequent, increases renal perfusion [5, 6]. It is estimated that about 20 to 40 % of diabetics will develop CKD to 3 decades after appearance of diabetes [7]. In addition to CKD, diabetic condition can be complicated by dyslipidemia which, according to the National Cholesterol Education Program of the National Institute of Health in USA, refers to atherogenic dyslipdemia occurring in people with type 2 diabetes and characterised by the elevation of serum triglyceride (TG) level and serum Low Density Lipoprotein Cholesterol level (LDL-c) and, reduction of the serum High Density Lipoprotein Cholesterol (HDL-c) level. It's also considered as one component of the metabolic syndrome [8]. The appearance of diabetic dyslipidemia is due to the insulin resistance or deficiency which affects keys enzymes and pathways of lipid metabolism. In the other hand, the occurrence of some chronic complications of diabetes such as CKD is mainly due to chronic uncontrolled hyperglycaemia [9-11]. The global prevalence of CKD in diabetics is not clearly estimated. In Africa, overall prevalence of CKD in diabetic population has been reported to fluctuate between 11% and 83% [12]. The exact national prevalence of CKD in diabetic Cameroonian is not documented. Studies carried-out in local areas or single town reported prevalence ranging from 5.7% to 53.1% [13-20].The present study, done in Buea, South-West region of Cameroon, aimed to at extending the estimation of the prevalence of CKD and diabetic dyslipidemia in patients with type 2 diabetes in Buea.

Material and Methods:

Study site and design

This was a cross-section study conducted at the diabetic clinic of Buea Regional Hospital and the Lambe Foundation for diabetes and hypertension in Buea, South-West Region of Cameroon. These two centers are the main ones where diabetic patients are followed-up every Tuesday and Thursday concerning the Buea Regional Hospital and, from Monday to Saturday at the Lambe Foundation. Patient recruitment and sample collection were done between January and May 2018. All the Biomedical analysis were carried out in the Medical Research and Applied Biochemistry Laboratory (MRABL) at the Faculty of Health Sciences of the University of Buea in Cameroon.

Recruitment of participants

All patients aged 19 and above with type 2 diabetes coming for routine diabetes follow-up and who signed the consent forms were recruited for the study. We excluded those diagnosed with renal failure, hepatic abnormalities or, with systemic disease. Menstruating females were asked to return after their menstrual period. People who did intensive physical exercise within the preceding 72 hours were also asked to return after 72 hours without intensive physical exercise. Patients were recruited during a period of 5 months where first kidney function was evaluated. For individuals with reduced kidney function according to our method, there were seen after 3 months period for second kidney function evaluation.

Data collection and management

We collected information from our participant using a data collection form. Age, weight height, medical and family history, blood pressure and fasting blood

glucose level were collected during the first and second visit, for people with reduced kidney function, high serum creatinine or high proteinuria. We collected 3 ml of fresh blood sample from every participant in a dried tube. The same day of the recruitment, patients received a clean, dried and sterile container with no preservative for urine collection and were trained for the first morning urine collection. The next day, they collected the first morning urine and brought back to hospital or Foundation at 8 a.m. at most. Blood and urine samples that were not analysed on the collection days were stored at 2-4^{o}C.

Clinical data measurements

We measured the blood pressure with an electronic device after 15 minutes of rest in the sitting position. We measured the height with a stadiometer and the weight with an electronic scale in light clothing and no shoes. We calculated the Body Mass Index (BMI) as weight (kg)/[height (m)]2 and classified based on WHO classification [21].We considered patient as normotensive when the Systolic Blood Pressure (SBP) was less than 140 mmHg and the Diastolic Blood Pressure (DBP) less than 90 mmHg [22].

Laboratory analysis

Parameters measured were serum glucose, serum creatinine, serum urea, urine creatinine, urine albumin, LDL, HDL, total cholesterol and TG with the molecular spectrometry Semi Auto Biochemistry Analyser, (BA-88, Mindray Biochemistry Analyser, China). The Glomerular Filtration Rate (GFR) was estimated using the Modified method of Diet in Renal Disease (MDRD), using serum creatinine as substrate according to Levey et al. (Levey et al., 2009). CKD stages were classified according to the recommendation of KDIGO (Levey, 2005). High serum creatinine was considered for result ≥ 1.2 mg/dL and ≥1.4 mg/dL for women and men respectively. Albumin Creatinine Ration (ACR) was used to evaluate the level of protein in urine. The indication of hyperuricemia was present if serum uric acid was >70 mg/L in men and >60 mg/L in women. We characterized diabetic dyslipidemia if TG is higher than normal (>150 mg/dL), LDL-C higher than normal (> 160 mg/dL) and HDL-c lower than normal (< 40 mg/dL for men and <50 mg/dL for women) (NCEP, 2002).

Data analysis

Data were entered in Microsoft Office Excel 2010, then analyzed with SPSS 20.0. Independent t-test and Ch-square test were used to compare means and variance between groups and $P < 0.05$was considered significant.

Ethical consideration

All participants to the survey signed an informed consent after having been informed verbally on the aim of the study as well as on its advantages, disadvantages and potential risk for their participation. The research protocol was approved by the Institutional Ethics Committee for Research on Human Health of the University of Douala. An Ethical clearance No 1157 IEC-UD/11/2017/T was granted for the study. Administrative clearance was obtained from the South-West Regional Delegation of Public Health. The Regional Hospital of Buea gave us an administrative authorization to carry-out our research.

Results:

Socio-demographic and clinical results

A total number of 120 diabetic patients were enrolled in this study. The socio-demographic and clinical characteristic of population are presented in table 1.

Table1: Socio-demographic and clinical characteristics

Variable	Frequency	Percentage
Gender		
Male	44	36.66%
Female	75	63.33%
Residence		
Urban	85	70.83%
Rural	35	29.16%
Marital status		
Single	7	05.83%
Married	71	59.16%
Widow(er)	40	33.33%
Divorced	2	01.66%
Age (Years)		
15-30	2	01.66%
31-45	11	09.16%
46-60	59	49.16%
≥61	48	40.00%
Blood Pressure (mmHg)		
Normotensive	41	34.16%
Hypertensive	79	65.83%
BMI (Kg/m^2)		
Under weight	*0*	00.00%
Normal weight	31	25.83%
Over weight	50	41.66%
Obese	39	32.50%
Medical History of HT		
Yes	64	53.33%
No	56	46.66%

The mean age of the population was 58.02 ± 10.57 years and ranged from 28 to 81 years. The age group of 46 to 60 years was the most represented with the percentage of 49.16%. The feminine sex was the most represented with 63.33%. The prevalence of hypertension (HT) according to the medical record book of our participant was 53.33% while 65.83% presented high blood pressure during the recruitment period of the study and, 32.50% was obese.

Biochemical analysis results

Table 2: Biochemical parameters

Variable	Mean				Average
	Men	Women	Levene's test for variance*	P Value**	
FBG (mg/dL)	185.50±51.04	202.32±76.43			201.34±85.62
S. Creat (mg/dL)	1.09±0.40	0.98±0.47	**0.859**	0.233	1.02±0.44
S. Urea (mg/dL)	32.62±57.52	20.64±18.32	0.098	0.292	29.57±34.63
ACR (mg/dL)	35.60±65	50.77±95	**0.324**	0.350	44.86±84.78
TG (mg/dL)	87.91±86.12	99.44±87.65	**0.841**	0.577	92.82±86.91
LDL-c (mg/dL)	27.62±26.90	43.94±45.05	0.096	**0.045**	37.60±40.05
HDL-c (mg/dL)	70.57±73.06	61.33±60.86	0.033	0.573	63.83±65.17
TC (mg/dL)	127.11±89.79	128.88±83.20	**0.406**	0.931	124.80±85.83
eGFR (MDRD)	98.37±87.43	89.55±43.49	**0.157**	0.466	92.76±62.92

*Equal variances are assumed if the result is greater than0.10

** Difference of means between groups is significant if the result is less than 0.05

Using quantitative method to measure the level of fasting blood glucose, a mean of 201.34±85.62 mg/dL was obtained with a predominance in female gender (202.32±76.43) compared to male gender (185.50±51.04). The average value of creatinine in serum was 1.02±0.44 mg/dL where men presented the high average than women (P Value=0.233). The average result of urea in serum was 29.57±34.63 mg/dL and the estimated ACR was 44.86±84.78 mg/g. The average value of TG, LDL-c, HDL-c and total Cholesterol was respectively 92.82±86.91mg/dL, 92.82±86.91 mg/dL, 63.83±65.17 mg/dL and 124.80±85.83 mg/dL and, women presented the high average value (P Value were respectively = 0.577, 0.045, 0.573 and 0.931).

Assessment of kidney function using MDRD and ACR

Table 3: Classification of different stages of CKD according to MDRD and ACR

Stage	eGFR (MDRD) (ml/min/1.73m^2)	ACR (mg/g)			Total [N=120 (%)]
		<30	30-300	>300	
No CKD	≥90	35	0	0	35 (29.16)
1	≥90	0	16	0	16(13.33)
2	60-89	29	11	4	44 (36.66)
3a	45-59	8	0	0	8 (06.66)
3b	30-44	7	9	0	16 (13.33)
4	15-29	1	0	0	1 (00.83)
5	<15	0	0	0	0(00.00)
Total [N=120 (%)]		80 (66.66)	36 (30.00)	4 (03.33)	

According to MDRD and ACR, the general mean of eGFR of the population was 92.76 ml/min/1.73m^2 and, woman population presented the lower value (89.55±43.49ml/min/1.73m^2) compared to men (98.37±87.43 ml/min/1.73m^2) with equal variance assumed (X^2 = 0.107) and without statistical significance (P value = 0.466). 70.83% of the population were diagnosed CKD where the prevalence of people at stage 2 was the high (36.60%). 20.83% presented CKD from stage 3 to 5 with an estimation of GFR less than 60ml/min/1.73m^2. According to the ACR, micro-albuminuria was present in 30% of the population and, 3.33% presented macro-albuminuria.

Assessment of dyslipidemia

Table 4: Correlation of diabetic dyslipidemia status and some factors

Stage	**Diabetic Dyslipidemia (mg/g)**		**X^2**
	Yes [N=120 (%)]	**No [N=120 (%)]**	
Gender			0.326
Female	40 (33.33)	36 (30.00)	
Male	18 (15.00)	26 (21.66)	
CKD status of Patients			0.219
No CKD	11 (09.16)	24 (20.00)	
Stage 1 CKD	9 (07.50)	7 (05.83)	
Stage 2 CKD	23 (19.16)	21 (17.50)	
Stage 3a CKD	6(05.00)	2 (01.66)	
Stage 3b CKD	9 (07.50)	7 (05.83)	
Stage 4 CKD	0 (00.00)	1 (00.83)	
Stage 5 CKD	0 (00.00)	0 (00.00)	
Albuminuria			0.118
Normo-albuminuria	35 (29.16)	45 (37.50)	
Micro-albuminuria	20 (16.66)	16 (13.33)	
Macro-albuminuria	3 (02.50)	1 (00.83)	
Total [N=120 (%)]	58 (48.33)	62 (51.66)	

The prevalence of Diabetic dyslipidemia was 48.33% with predominance in female gender (36.66%) compared to male (11.66%) (X^2=0.326). According to the ACR, the proportion of healthy diabetic with normal albuminuria without diabetic dyslipidemia was 37.50% and 29.16% was the percentage of diabetic with normal albuminuria and diabetic dyslipidemia (X^2=0.118). 16.66% of the population presented the co-affection micro-albuminuria and diabetic dyslipidemia and, 2.50% presented the co-affection macro-albuminuria and diabetic dyslipidemia. The prevalence of diabetic dyslipidemia among diabetic with CKD is 39.16% (X^2=0.118). In the general population of our study with and without CKD, the proportion of people without CKD and without diabetic dyslipidemia was 20% and, 9.16% was the proportion of people without CKD but with diabetic dyslipidemia (X^2=0.219).

Discussion:

This study has been carried-out in a group of diabetic patients coming for their routine follow-up in two centers of diabetes and hypertension in Buea, South-west of Cameroon. The study was aimed at identifying the prevalence of CKD and the prevalence of diabetic dyslipidemia in this group of population. We noticed an average value of FBG in this population (201.34±85.62 mg/dL) higher than the normal range of 80-130 mg/dL recommended by the American Diabetes Association [23]. From our study, the main finding was that CKD is prevalent at 70.83% of the diabetic population. This prevalence is slightly higher than 31%, 29.8% and 20.50% in diabetic patients respectively in some studies carried out in Cameroon, Chad and Congo [14, 24, 25]. The differences could come from the techniques and methods used to estimate the GFR. In our study, all patients with persistent proteinuria and/or reduced eGFR during 3 months at least were considered CKD patients. Compared to other studies where CKD were considered only for participants from stage 3 to 5 using an eGFR less than 60ml/min according to MDRD, a prevalence of 20.83% was estimated and, it was lower than some studies did among diabetic Cameroonians where prevalences of 25%, 27% and 37% were got [15, 17, 20]. The stage 2 of CKD was the more represented and, we did not diagnose participant at ESRD. The prevalence of micro-albuminuria was reported at 30.00% of the population and it is slightly same with the prevalence of 31%, 31.56% and 37.4% reported respectively in Diabetic population in Cameroon, Pakistan and in Saoudi Arabia [16, 26, 27]. In some studies, compared to our result, high prevalence of micro-albuminuria in diabetic population has been found such as 46.5% in Nepal, 50% 20 years ago in Cameroon and 68.4% in Nigeria [13, 28, 29]. Some other studies got lower prevalence in example of 21.8% in Democratic Republic of Congo and 24.8% in India [30, 31]. All these differences might come from the geographical differences, techniques of sample collection used, method of CKD level estimation or type of diabetes between these populations. Despite them, this result showed the important presence of micro-albumiria in diabetic population in Cameroon with a representation at the one third of the diabetics in our study.

Diabetic dyslipidemia affected about half of the population with a prevalence of 48.9%. Taking in consideration the prevalence of diabetic dyslipidemia in each one group separately, male and female, the prevalence in female population was high (52.63%) compared to the prevalence in male population (40.90%)(X^2=0.326). It has been shown that, according to the status of diabetic with CKD and diabetic without CKD separately, diabetic dyslipidemia was more prevalent in the sub-population of diabetic with CKD (55.29%) compared to the sub-population of diabetic without CKD (31.42%)(X^2=0.219).

Conclusion:

This prevalence of CKD in diabetic population got at 70.83% has shown the importance of diabetic monitoring to assess routinely their kidney function. Despite the limitation due to limited sample size of our study, a prevalence of 48.33% of diabetic dyslipidemia was found. This study is a pioneer in terms of the assessment the both prevalence of CKD and diabetic dyslipidemia in diabetic patients in Cameroon and, more other studies should be focused on diabetic CKD patient in Cameroon in order to estimate, in more large population, risk factors and pattern of diabetic dyslipidemia in diabetic CKD patient so to improve the management of kidney complications of diabetes in Cameroon.

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