

Microalbuminuria and Associated Factors in Diabetics at the CNHU-HKM of Cotonou

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Abstract

Diabetes mellitus is a disease of great frequency and is a major public health problem. Several complications can occur during the course of diabetes such as diabetic nephropathy, which starts with microalbuminuria in diabetic patients. This was a cross-sectional and analytical study which took place from 23 September to 23 December 2021 in the Endocrinology-Metabolism-Nutrition Department of the CNHU-HKM of Cotonou, Benin. We carried out an exhaustive census of the patients. Type 2 diabetic patients were included in the study, and 24-hour microalbuminuria, fundus examination and assessment of complications were performed. We identified 145 type 2 diabetic patients of whom 44 had positive microalbuminuria, *i.e.* a prevalence of 30.3%. There were 61 men and 84 women with a sex ratio of 0.72. The mean age was 59 years with extremes of 26 and 85 years. The complications identified in diabetics with positive microalbuminuria were Neuropathy (43.2%), Nephropathy (22.7%) and Retinopathy (20.5%). Factors associated with microalbuminuria in diabetics were: age, occupation, hypertension, diabetes imbalance, erectile dysfunction. **Conclusion:** Microalbuminuria is common in type 2 diabetes. It should be managed early to slow the progression of kidney disease to the end stage.

Keywords

Diabetes, Microalbuminuria, Associated Factors, Benin

1. Introduction

Developing countries are faced with the emergence of non-communicable diseases (NCDs), which have very significant consequences in terms of morbidity and mortality. However, NCDs (cardiovascular diseases, type 2 diabetes, cancers, etc.) are on the rise all over the world, including in the countries of the South, in

terms of incidence and mortality. Among the NCDs is diabetes, which is characterised by chronic hyperglycaemia, *i.e.* an excess of sugar in the blood and therefore an excessively high level of glucose (blood sugar). The prevalence of diabetes is increasing worldwide, especially in developing countries. Between 2000 and 2016, premature mortality attributable to diabetes increased by 5% in low-income countries (WHO) [1]. Benin, a developing country, has not been left out of this epidemic trend. According to a national survey in 2001, the prevalence of diabetes in Benin was 1.01%, but this figure rose to 2.6% in 2008 according to the STEPS survey [2] and then to 4.5% in 2015 and 5.1 in 2016 [3]. There are two main types of diabetes: type 1 diabetes which affects about 10% of diabetics and type 2 diabetes which affects 90%. Other types of diabetes affect the remaining 2% (MODY, LADA or diabetes secondary to certain diseases or medication). Several complications can occur during diabetes, such as diabetic nephropathy. Diabetic nephropathy (DN) is the leading cause of end-stage renal disease worldwide [4]. In type 2 diabetics, it begins with microalbuminuria and, as in the general population, is primarily associated with an increased cardiovascular risk. In view of these observations, in a population characterised by a high rate of illiteracy and a low socio-economic level, the present study aims to determine the prevalence of microalbuminuria in diabetics and the associated factors in the Endocrinology-Metabolism-Nutrition Department of the CNHU-HKM of Cotonou in 2021.

2. Study Methods

The study was a cross-sectional and analytical study that took place from September 23 to December 23, 2021 and included diabetic patients followed up in the endocrinology department of the CNHU-HKM of Cotonou for the management of their diabetes during the study period and who gave their consent. Diabetic nephropathy is the kidney damage of diabetes mellitus. The first stage of diabetic nephropathy is microalbuminuria. The variables studied were age, sex, place of residence, level of education, occupation, religion, marital status, ethnicity, duration of diabetes, glycaemic control, dyslipidaemia and complications of diabetes. The data were collected on the Kobo Collect software and then processed and analysed using R. version 3.6.1. The comparison of proportions and percentages was carried out with the Chi² test or Fisher's exact test, depending on the case. A $p < 0.05$ was considered statistically significant. The threshold for statistical significance was 5%.

3. Results

In our sample of 145 type 2 diabetics included in the study, 44 patients had positive microalbuminuria.

3.1. Socio-Demographic Characteristics

Our study population is made up of both sexes and ranges in age from 26 to 85

years.

Most of the subjects were in the age group 56 - 66 years. The mean age of the study population was 59.74 ± 8.83 years with extremes ranging from 26 to 85 years. The median class was 56 - 70 years.

There was a predominance of women (57.9%) compared to men (2.14%). The majority of our patients, regardless of sex, were between 46 and 76 years old (**Table 1**).

Table 1. Socio-demographic characteristics of diabetic patients followed up in Endocrinology-Metabolism-Nutrition at the CNHU-HKM of Cotonou during the study period (N = 145).

	Number	Percentage (%)
Gender		
Male	61	42.0
Female	84	57.9
Age (year)		
[26 - 36]	2	1.4
[36 - 46]	8	5.5
[46 - 56]	30	20.7
[56 - 66]	78	53.8
[66 - 76]	24	16.6
[76 - 86]	3	2.1
Level of education		
No	5	3.5
Primary	20	13.8
Secondary	62	42.8
Superior	58	40.0
Marital status		
Married	134	92.4
Divorced	3	2.1
Widower	7	4.8
Single	1	0.7
Employment status		
Employee	61	42.1
Artisan	5	3.5
Reseller/Dealer	15	10.3
Housekeeper	9	6.2
Retired	5	37.9

3.2. Characteristic of Diabetes

All patients had type 2 diabetes and 57.9% of these patients had suffered from diabetes for more than 5 years. The majority of patients (90.3%) were being treated with oral antidiabetic drugs. Diabetes imbalance was found in 69.7% of the patients (**Table 2**).

3.3. Vascular Risk Factors in Diabetic Patients

Hypertension was present in 71.7% of diabetic patients, dyslipidaemia in 55.9% and stroke in 5.5%. The frequency of patients taking alcoholic beverages at least once a month was 15.2% and that of those who occasionally used tobacco was 2.8.

After recruitment, seventy-seven patients were overweight (53.1%) and 26 patients (17.9%) were obese. The average waist circumference of our patients was 93 cm. The majority of patients (70.8%) were abdominally obese.

Hypertension was present in 71.7% of patients, most of whom were women (**Table 3**).

3.4. Diabetes-Related Complications

During recruitment, the most recorded complications included neurological complications (26.4%), followed by ocular complications (21.4% of cases).

Table 2. Distribution of patients according to type of diabetes, treatment, length of time and diabetes control in the Endocrinology-Metabolism-Nutrition Department of the CNHU-HKM, Cotonou/Benin, 2021.

	Number	Percentage (%)
Age of diabetes (years)		
<5	61	42.1
≥5	84	57.9
Type of diabetes		
Type 1	00	00
Type 2	145	100
Type of treatment		
ADO	131	90.3
Insulin	5	3.5
ADO + Insulin		
Diabetes control		
HbA1c ≤ 7	44	30.3
HbA1c > 7%	101	69.7

HbA1c = Glycated haemoglobin.

3.5. Presentation of the Population with Microalbuminuria

Of the 145 patients surveyed, 44 had microalbuminuria, a prevalence of 30.3%.

The number of patients with positive microalbuminuria was 44 (24 women and 20 men). The majority of patients with positive microalbuminuria were in the 56 - 66 age group.

The majority with positive microalbuminuria were also hypertensive (36/44 patients).

The most identified complications in diabetics with positive microalbuminuria were dyslipidaemia (40.7%), neuropathy (27.3%), nephropathy (18.2%) and retinopathy (29.5%) (**Table 4**).

Factors associated with microalbuminuria in patients followed in Endocrinology Metabolism Nutrition at the CNHU-HKM of Cotonou in 2021.

3.6. Univariate Analysis

No statistically significant relationship was observed between microalbuminuria and gender ($p = 0.58$), education level ($p = 0.16$), marital status ($p = 0.09$), and employment status ($p = 0.09$). However, there was a statistically significant relationship between microalbuminuria and age ($p < 0.001$). Indeed, 41.1% of patients aged over 59 years had microalbuminuria compared to 10% of those aged under 59 years (**Table 5**).

Table 3. Vascular risk factors identified in diabetic patients followed at the Endocrinology-Metabolism-Nutrition Department of the CNHU-HKM of Cotonou during the study period (N = 145).

	Number	Percentage (%)
High blood pressure	104	71.7
Alcohol	22	15.2
Tobacco	4	2.8
History of stroke Dyslipidemia	8	5.5
Yes	81	55.9
No	64	44.1

Table 4. Distribution of patients according to diabetes-related complications.

Complication	Number	Percentage
Stroke	08	5.5
Erectile dysfunction	10	6.9
Neuropathy	38	26.4
Retinopathy	31	21.4
Nephropathy	21	14.5
Renal failure	06	4.1
No complications	31	21.3
Total	145	100

Table 5. Relationship between microalbuminuria and socio-demographic characteristics in patients followed up in Endocrinology Metabolism Nutrition at the CNHU-HKM of Cotonou in 2021.

	Total	Microalbuminuria				Total
	(N)	N	%	RP	IC 95% RP	
Gender						0.58
Male	61	20	32.8	1.1	[0/7 - 1.9]	
Woman	84	24	28.6	1.0		
Age						0.00
<59	50	05	10.0	1.0		
≥59	95	39	41.1	4.1	[1.7 - 9.8]	
Level of education						0.16
Educated	140	41	29.3	1.0		
Not educated	05	03	60.0	2.0	[0.9 - 4.4]	
Marital status						0.09
Married	134	38	28.4	1.0		
Single	11	06	54.6	1.9	[0.9 - 3.5]	
Employment status						0.09
Employee	61	13	21.3	0.6	[0.3 - 1.4]	
Not employed	29	09	31.0	1.0		
Retired	55	22	40.0	1.3	[0.7 - 2.4]	

No statistically significant relationship was observed between microalbuminuria and Retinopathy ($p = 1.00$), Diabetic Nephropathy ($p = 0.07$), Peripheral Neuropathy ($p = 0.09$), and Stroke ($p = 0.25$). **Table 6** shows the relationship between microalbuminuria and diabetic complications (**Table 7**).

3.7. Biological and Clinical Parameters

No statistically significant relationship was observed between microalbuminuria and diabetes age ($p = 0.71$), however, there was a statistically significant relationship between microalbuminuria and glycaemic control: HbA1c > 7% ($p = 0.03$), dyslipidaemia ($p = 0.01$), hypertension ($p < 0.001$) and erectile dysfunction ($p < 0.001$) (**Table 7**).

3.8. Multivariate Analysis

Table 8 shows the univariate and multivariate analysis of the occurrence of microalbuminuria. In multivariate analysis, after adjustment for education level, marital status, occupational status, diabetic nephropathy, peripheral neuropathy and erectile dysfunction, microalbuminuria was significantly associated with age ($p = 0.00$), glycaemic control ($p = 0.01$), dyslipidaemia ($p = 0.03$) and hypertension ($p < 0.001$). Patients over 59 years of age were 5.3 times more likely to have

Table 6. Relationship between microalbuminuria and diabetic complications in patients followed up in Endocrinology-Metabolism-Nutrition at the CNHU-HKM of Cotonou in 2021.

	Total	Microalbuminuria				Total
	(N)	N	%	RP	IC 95% RP	
Retinopathy						
Yes	31	09	29.0	1.0		1.00
No	114	35	30.7	1.1	[0.6 - 1.9]	
						0.07
Diabetic nephropathy						
Yes	21	10	47.6	1.7	[0.9 - 2.5]	
No	124	34	27.4	1.0		
						0.09
Peripheral neuropathy						
Yes	50	20	40.0	1.7	[0.9 - 2.5]	
No	95	24	25.3	1.0		
						0.25
Stroke						
Yes	08	04	50.0	1.7	[0.8 - 3.5]	
No	137	40	29.2	1.0		

Table 7. Relationship between microalbuminuria and biological and clinical complications in patients followed in Endocrinology Metabolism Nutrition at the CNHU-HKM of Cotonou in 2021.

	Total	Microalbuminuria				Total
	(N)	N	%	RP	IC 95% RP	
Age of diabetes						
<5	61	17	27.9	1.0		0.71
≥5	84	27	32.1	1.2	[0.7 - 1.9]	
						0.03
Glycemic balance						
HbA1c < 7%	101	25	24.8	1.0		
HbA1 > 7%	44	19	43.2	1.7	[1.1 - 2.8]	
						0.01
Dyslipidemia						
Yes	11	07	63.6	2.3	[1.4 - 3.9]	
No	134	37	27.6	1.0		
						0.00
HTA						
Yes	104	41	39.4	5.4	[1.8 - 10.4]	
No	41	03	07.3	1.0		
						0.00
Erectile dysfunction						
Yes	10	08	80.0	3.0	[2.0 - 4.5]	
No	135	36	26.7	1.0		

Table 8. Factors associated with microalbuminuria in patients followed in Endocrinology Metabolism Nutrition at the CNHU-HKM of Cotonou in 2021.

	Univariate analysis			Multivariate analysis		
	OR _b	[IC 95% OR]	p	OR _a	[IC 95% OR]	p
Age						
<59	1.0			1.0		
≥59	4.1	[1.7 - 9.8]	0.00	5.3	[1.6 - 7.4]	0.00
Level of education						
Educated	1.0			1.0		
Not educated	2.0	[0.9 - 4.4]	0.16	1.3	[0.2 - 3.2]	0.78
Marital status						
Married	1.0			1.0		
Single	1.9	[0.9 - 3.5]	0.09	3.3	[0.7 - 5.4]	0.14
Employment Status						
Employee	0.6	[0.3 - 1.4]		0.7	[0.2 - 2.5]	0.52
Not employed	1.0		0.09	1.0		
Retired	1.3	[0.7 - 2.4]		1.1	[0.3 - 4.6]	0.88
Diabetic Nephropathy						
Yes	1.7	[0.9 - 2.5]	0.07	1.3	[0.1 - 1.4]	0.14
No	1.0			1.0		
Peripheral neuropathy						
Yes	1.7	[0.9 - 2.5]	0.09	1.8	[0.3 - 2.1]	0.51
No	1.0			1.0		
Glycemic balance						
HbA1c < 7%	1.0			1.0		
HbA1 > 7%	1.7	[1.1 - 2.8]	0.03	1.6	[1.1 - 4.7]	0.01
Dyslipidemia						
Yes	2.3	[1.4 - 3.9]	0.01	2.2	[1.2 - 4.5]	0.03
No	1.0			1.0		
HTA						
Yes	5.4	[1.8 - 10.4]	0.00	7.1	[2.0 - 10.4]	0.00
No	1.0			1.0		
Erectile dysfunction						
Yes	3.0	[2.0 - 4.5]	0.00	2.4	[0.7 - 5.2]	0.11
No	1.0		1.0			

microalbuminuria than patients under 59 years of age. Similarly, patients with glycaemic imbalance were about twice as likely to have microalbuminuria compared to those without. Furthermore, the risk of developing microalbuminuria

was 2.2 times greater in patients with dyslipidaemia. The risk of developing microalbuminuria in patients with hypertension was 7.1 times that of patients without hypertension.

4. Discussion

The prevalence of microalbuminuria in diabetics in our present study was 30.3%. Several authors in their studies have come to a similar result.

During our study, we counted 145 type 2 diabetic patients with a predominance of women represented at 57.93%. This predominance of women was also found by Djrolo *et al.* 56.1% [3], Agboton *et al.* (58.6%) in Benin [5] and also by Yamego *et al.* [6] in Senegal.

They had a mean age of 59 years with extremes ranging from 26 to 85 years. This average is similar to that of Thaleb *et al.* [7] in Lebanon (56 years) and Yamego *et al.* [6] in Senegal (58 years).

This 30.3% prevalence of microalbuminuria is far from those found by Djrolo (39.2%) [3] Monabeka *et al.* [8] in Congo (37.9%) and by Yamego *et al.* [6] in Senegal (36.8%) in 2012. However, it is lower than that found by Charfi *et al.* in Tunisia (2010) who found a prevalence of 15% [9]. This difference would be due to the fact that their sample size was small and their study was retrospective. Also, this prevalence among type 2 diabetics varies between countries and studies. This would mean that diabetic patients in our series benefit from early management once in the microalbuminuria stage which prevents progression to the advanced stages.

In addition, microalbuminuria is significantly associated with hypertension, diabetes imbalance in some studies such as Djrolo in Benin [3], Yamego *et al.* in Senegal [6]. Our study also shows that type 2 diabetics with microalbuminuria have poor glycaemic control compared to those without microalbuminuria.

From the analysis of these results, we can deduce that microalbuminuria is associated with age, poor glycaemic control revealed by an HbA1c level above 7% as reported in several studies [6] [10] [11] [12] [13]. This is especially true as we found in our series an association between glycated haemoglobin and microalbuminuria in type 2 diabetics (OR = 1.6; 95% CI: 1.1 - 4.7; $p = 0.01$).

Nephropathy is associated with a particular dyslipidemia, by increase of lipoprotein(a) linked to renal loss of apoCII (LPL activator), and accumulation of apoCII (LPL inhibitor). Boufaïda *et al.* 2016 (Morocco) [14] noted in their study conducted in Morocco a significant relationship between dyslipidemia ($p = 0.008$) and microalbuminuria in diabetics. Dyslipidemia ($p = 0.03$) is also associated with microalbuminuria in diabetics in our study.

The determinants of microalbuminuria can be divided into two factors non-modifiable factors (age) and modifiable factors (diabetes control, hypertension, and dyslipidaemia) [15].

Multivariable analysis enabled us to identify an association between microalbuminuria and age: $p = 0.00$, hypertension: $p = 0.00$, diabetes control: $p = 0.01$,

dyslipidaemia $p = 0.03$. These different factors have been identified in many other studies by various authors such as the study by Varghese *et al.* [15], Yamego *et al.* [6], Monabeka *et al.* [8]. In these studies, the main factors found were age, hypertension, unbalanced diabetes and the length of time diabetes had been present. In our study, however, statistical analysis revealed no significant association between microalbuminuria and the duration of diabetes.

5. Conclusion

At the end of this study which focused on microalbuminuria and associated factors in diabetics followed at the University Clinic of Endocrinology Metabolism Nutrition of the CNHU-HKM of Cotonou, Benin in 2021, it appears as follows. The prevalence of microalbuminuria is high 30.3% in the diabetics included in the study. Factors associated with microalbuminuria are: age, occupation, hypertension, unbalanced diabetes, erectile dysfunction, dyslipidaemia, the determination of these risk factors is essential for the identification of patients at risk and management.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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