

Factors Associated with Poor Glycemic Control among Type 2 Diabetics Followed at Yopougon University Hospital

Leita Sarkis Beroh^{1*}, Ndoh Ngrabé Nodje-Assal¹, Habiba Abdoulaye Affadine¹,
Dezoumbé Néné², Mouandilmadje Djikoldjinguem Marschall², Yao Assita³,
Abodo Jacko Reedor Fetè³

¹Department of Biomedical Sciences, University of Abéché, Abéché, Chad

²Department of Biomedical Sciences, University of N'Djamena, N'Djamena, Chad

³Department of Biomedical Sciences, Félix Houphouët Boigny University, Abidjan, Côte d'Ivoire

Email: *beroleita@gmail.com

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Abstract

Diabetes mellitus is recognized worldwide as a public health problem due to its ever-increasing prevalence and its complications. This study aims to identify the factors associated with poor glycemic control in people with type 2 diabetes in order to improve their management. This was a cross-sectional analytical study of patients with type 2 diabetes followed at the Yopougon University Hospital from January 2020 to March 31, 2021. Poor glycemic control was defined as an HbA1c level of $\geq 7\%$. A multivariate logistic regression analysis was performed to identify independently associated factors. During our study, we enrolled a total of 300 patients, of whom 196 (65.3%) had poor glycemic control. In the multivariate analysis, the factors associated with poor glycemic control were: nonadherence to treatment (ORa = 4.12; 95% CI [2.34 - 7.26]; $p < 0.001$), failure to follow the diet (ORa = 3.58; 95% CI [2.01 - 6.37]; $p < 0.001$), use of traditional medicine (ORa = 3.21; $p = 0.001$), and duration of diabetes ≥ 5 years (ORa = 2.87; $p = 0.002$), obesity (ORa = 2.43; $p = 0.004$), lack of health insurance (ORa = 2.18; $p = 0.012$), and low educational attainment (ORa = 1.96; $p = 0.031$). Poor glycemic control is common among people with diabetes receiving care at the Yopougon health center. To improve it, it will be necessary to intensify therapeutic education, step up treatment, and improve health coverage.

Keywords

Type 2 Diabetes, Poor Glycemic Control, Glycated Hemoglobin, Côte d'Ivoire

1. Introduction

Diabetes mellitus is a chronic disease recognized worldwide as a devastating epidemic [1]. The International Diabetes Federation (IDF) estimated that in 2019, 463 million people worldwide were living with diabetes, and that this figure will reach 700 million by 2045 if nothing is done [2]. Type 2 diabetes accounts for the large majority of cases, at 90% [3]. Its progression is driven by changing economic conditions and lifestyles associated with urbanization, together with population aging [4] [5]. This increase is of great concern because of its cardiovascular complications, which are a major source of morbidity and mortality: disability, functional impairment, reduced quality of life, and heavy healthcare costs.

Africa is not spared from this trend. The IDF estimated that 19 million people in the African population were living with diabetes in 2019 [6]. One of the challenges facing healthcare providers is to ensure rigorous management that takes into account all cardiovascular risk factors, in order to prevent complications and improve these patients' quality of life.

It is well established that improved glycemic control is associated with a reduction in microvascular and macrovascular complications [7]. Good glycemic control is defined as a glycated hemoglobin (HbA1c) level of 7% or lower [8]. However, this glycemic target remains difficult to achieve in most cases. Indeed, the prevalence of poor glycemic control among type 2 diabetics in sub-Saharan Africa varies widely: 81% in Burundi [9], 68% in Cameroon, and 84% in Guinea [10].

In Côte d'Ivoire, there are few data on the prevalence of poor glycemic control among type 2 diabetics, and even fewer on its associated factors. Identifying these factors could help improve the management of diabetic patients and prevent potential complications. This is the purpose of our study.

2. Materials and Methods

2.1. Study Design and Setting

This was an analytical, cross-sectional study conducted from January 2020 to March 30, 2021, in the Endocrinology-Diabetology Department of Yopougon University Hospital in Abidjan, specifically within its outpatient consultation unit.

2.2. Study Population and Inclusion Criteria

The study population consisted of all type 2 diabetic patients followed at Yopougon University Hospital during the study period.

- Inclusion criteria:
 - Patients with a diagnosis of type 2 diabetes established according to WHO criteria, followed at Yopougon University Hospital for at least 6 months.
 - Type 2 diabetic patients followed at Yopougon University Hospital who had undergone the HbA1c test at least twice.
- Non-inclusion criteria:
 - Patients with a type of diabetes other than type 2;

- Patients with confirmed cardiovascular disease or a comorbidity for whom the 7% target is difficult to achieve because of the risk of hypoglycemia;
- Type 2 diabetic patients who became pregnant during follow-up.

2.3. Variables Studied

Poor glycemic control was defined as an HbA1c level $\geq 7\%$, in accordance with the recommendations of the American Diabetes Association (ADA) and the African Society for Diabetology and Endocrinology (SFADE).

- The variables studied included:
 - Sociodemographic factors (age, sex, education level, occupation);
 - Clinical factors (diabetes duration, body mass index, treatment type, comorbidity).

2.4. Data Collection

We initially identified the records of all patients who had consulted Yopougon University Hospital for type 2 diabetes. We then listed the patients with poor glycemic control who met our inclusion criteria and administered pre-established questionnaires to them.

2.5. Data Analysis

The collected data were entered and analyzed using EPI-INFO version 7 software. Tables, graphs, and figures were produced using Microsoft Office 2010 Excel and Word. Univariate analysis was performed using the chi-square independence test. The difference was considered statistically significant when $p < 0.05$.

3. Results

During the study period, 568 patients consulted Yopougon University Hospital, of whom 300 met the study criteria (52.7%). The 268 exclusions were related to incomplete records, pregnancy, and type 1 diabetes. The study population comprised 186 women (62.0%) and 114 men (38.0%), giving a sex ratio of 1.63. The mean age was 52.4 ± 11.8 years (See **Table 1**).

Table 1. Distribution of poor glycemic control according to sociodemographic characteristics (n = 300).

Variable	n (%)	HbA1c $\geq 7\%$ n (%)
Female sex	186 (62.0%)	127 (68.3%)
Male sex	114 (38.0%)	69 (60.5%)
Mean age $\pm$ SD (years)	52.4 ± 11.8	-
Age < 40 years	54 (18.0%)	40 (74.1%)
Age 40 - 60 years	162 (54.0%)	108 (66.7%)
Age > 60 years	84 (28.0%)	48 (57.1%)

Continued

No education/primary school	132 (44.0%)	98 (74.2%)
Secondary/higher education	168 (56.0%)	98 (58.3%)
Insured patients	126 (42.0%)	69 (54.8%)
Uninsured patients	174 (58.0%)	127 (73.0%)

The overall prevalence of poor glycemic control ($\text{HbA1c} \geq 7\%$) was 65.3% (196/300); the mean HbA1c value in the population was 8.4%, ranging from 5.2% to 14.6% (See **Tables 1-3**).

Table 2. Distribution of poor glycemic control according to clinical factors (n = 300).

Clinical variable	n (%)	HbA1c $\geq 7\%$ n (%)
Diabetes duration < 5 years	102 (34.0%)	57 (55.9%)
Diabetes duration ≥ 5 years	198 (66.0%)	139 (70.2%)
Obesity ($\text{BMI} \geq 30 \text{ kg/m}^2$)	138 (46.0%)	104 (75.4%)
Associated hypertension	168 (56.0%)	117 (69.6%)
Insulin therapy	84 (28.0%)	63 (75.0%)
Dual oral therapy	126 (42.0%)	82 (65.1%)
Oral monotherapy	90 (30.0%)	51 (56.7%)

Table 3. Distribution of poor glycemic control according to behavioral factors (n = 300).

Behavioral factor	n (%)	HbA1c $\geq 7\%$ n (%)
Therapeutic non-adherence	186 (62.0%)	148 (79.6%)
Dietary recommendations not followed	204 (68.0%)	156 (76.5%)
Sedentary lifestyle (<150 min/week)	222 (74.0%)	164 (73.9%)
Traditional self-medication	114 (38.0%)	91 (79.8%)
Irregular follow-up (<4 visits/year)	168 (56.0%)	126 (75.0%)

Clinical Factors Associated with Poor Glycemic Control

In the study population, 198 patients (66.0%) had been living with diabetes for more than 5 years (See **Table 2**). Obesity ($\text{BMI} \geq 30 \text{ kg/m}^2$) affected 128 patients (46.0%); 168 patients (58.0%) also had arterial hypertension; and the majority of patients were on dual oral therapy, 126 (42.0%).

4. Discussion

4.1. Sociodemographic Factors

During our study period, 568 diabetic patients consulted at Yopougon University Hospital, of whom we included 300. Of these 300 patients, 196 had poor glycemic

control (HbA1c $\geq 7\%$), giving a prevalence of 65.3%. This prevalence is comparable to that reported by Amoah *et al.* in Ghana (63.2%) [11] and by Lokrou *et al.* in Côte d'Ivoire (61%) [12]. These figures highlight the need to optimize diabetes treatment in developing countries in order to minimize its complications. Our data contrast with those of Cai in China (31.5%) [13].

The mean HbA1c value was 8.4%, a concerning figure given the associated complications. Indeed, each 1% increase in HbA1c is associated with an increased risk of complications: a 37% increase in the risk of macrovascular complications and a 14% increase in the risk of myocardial infarction, according to UKPDS data [14].

The mean age was 52.4 ± 11.8 years, with the 40 - 60 year age group predominating. The same finding was reported by Barankanira in Burundi [9]. The high proportion of relatively young patients in our study is concerning and raises questions about the challenges to be addressed in preventing cardiovascular complications and the risk of premature death.

Unlike the findings of Al-Nuaim *et al.* in Saudi Arabia [15] and Traoré *et al.* in Burkina Faso [16], who identified sex as a factor associated with poor glycemic control, sex was not a risk factor for poor glycemic control in our study. The same finding was reported by Ben Abdelaziz *et al.* in Tunis [17].

Financial dependence and lack of health insurance coverage (aOR = 2.18) negatively affect glycemic balance (Table 4). These results confirm those reported in the literature, which show that low socioeconomic status affects access to healthcare services and quality of care [18]-[20].

Table 4. Independent factors associated with poor glycemic control—Multivariate analysis (n = 300).

Associated factor	Adjusted OR	95% CI	p-value
Therapeutic non-adherence	4.12	[2.34 - 7.26]	<0.001
Non-adherence to dietary recommendations	3.58	[2.01 - 6.37]	<0.001
Traditional self-medication	3.21	[1.72 - 5.98]	0.001
Diabetes duration ≥ 5 years	2.87	[1.54 - 5.35]	0.002
Obesity (BMI ≥ 30 kg/m²)	2.43	[1.38 - 4.28]	0.004
Uninsured patients	2.18	[1.22 - 3.89]	0.012
Low education level	1.96	[1.10 - 3.50]	0.031
Irregular follow-up (<4 visits/year)	1.84	[1.04 - 3.25]	0.043

Regarding educational status, a low education level (aOR = 1.96) was associated with poor glycemic control in our study. Our data corroborate many other studies that have found an association between low education level and poor glycemic control [21] [22]. This result may be explained by the difficulty these patients have in understanding therapeutic education, leading them to resort more often to traditional treatment for managing their diabetes.

4.2. Diabetes-Related Data

In the literature, opinions on the relationship between diabetes duration and glycemic control are divided. Some authors found that diabetes duration was not a risk factor for poor glycemic control [23]. Others reported that a duration greater than 10 years was associated with poor glycemic control [24], while still others found the opposite [25] [26]. For Valle *et al.*, newly diagnosed patients (<3 years) had good glycemic control [27]. In our study, a diabetes duration of more than 5 years (aOR = 2.87) was associated with poor control, with a statistically significant difference. This difference may be explained by the progressive deterioration of pancreatic beta-cell function in the islets of Langerhans over time, which makes glycemic balance increasingly difficult to achieve.

Regarding cardiovascular risk factors, obesity (BMI ≥ 30 kg/m²) was a risk factor for poor glycemic control in our study (aOR = 2.43). This finding was also reported by Bruno G. and Blaum CS *et al.* [28] [29]. Indeed, obesity causes insulin resistance, and the high prevalence of obese patients in our study worsened the risk of poor glycemic control. Factors such as arterial hypertension and dyslipidemia were not risk factors for poor glycemic control in our study.

4.3. Behavioral Factors

Among the behavioral factors associated with poor glycemic control, we identified therapeutic non-adherence, non-adherence to dietary recommendations, and reliance on traditional therapy as strongly associated factors.

Non-adherence to treatment is an obstacle to good glycemic balance (aOR = 4.12). This result is consistent with the meta-analysis by Krass *et al.* of 28 studies, which concluded that non-adherence multiplies the risk of poor glycemic control by 3 to 5 times [30]. In our study, the reasons cited by patients for non-adherence to treatment included financial difficulties in purchasing medications and attending consultations, mistaken beliefs about chronic illness, and reliance on traditional therapy.

The second behavioral factor associated with poor glycemic control was non-adherence to dietary recommendations (aOR = 3.58). Dietary recommendations are difficult to follow.

This observation highlights the need to adapt nutritional advice to local dietary habits, as recommended by several authors [31] [32].

The third factor identified in our study was reliance on traditional therapy (aOR = 3.21). Numerous Sahelian and West African studies have reported prevalences ranging from 30% to 55%. This phenomenon is often responsible for interruptions in conventional treatment [33].

5. Conclusion

Poor glycemic control is frequently encountered among diabetics followed at Yopougon University Hospital, mainly driven by therapeutic non-adherence, non-adherence to dietary recommendations, and reliance on traditional medi-

cine, together with a long diabetes duration, obesity, lack of health insurance coverage, and low education level. Improving glycemic control in this population will require intensifying therapeutic education, intensifying insulin therapy where indicated, and extending health insurance coverage to a greater number of patients.

Author Contributions

Author 1 initiated the project; co-authors 2 and 3 contributed to the analysis and writing. The other co-authors contributed to proofreading, guiding the writing process, and editing the manuscript.

Conflicts of Interest

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

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