

QUALITY OF DIABETIC CARE IN A TERTIARY HEALTH CARE FACILITY IN ILORIN, NIGERIA

Simeon Adelani Adebisi¹, Kennet Oghagbon¹, Ahmed Kayode Jimoh¹, Tanimola Akande²,
John Kola Olarinoye³

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SUMMARY

In patients with type 2 diabetes, the risk of diabetic complications is strongly associated with previous hyperglycemia. In Nigeria, the incidence of type 2 diabetes mellitus and its complications is on the increase. The objective of this study was to assess the quality of diabetic care for type 2 diabetes mellitus patients at our health care facility. This cross-sectional study included type 2 diabetic patients attending Diabetic Clinic, Ilorin University Teaching Hospital. Glycated hemoglobin (HbA_{1c}) as an index of medium term glycemic control was assayed in established type 2 diabetics. The results obtained were evaluated against the American Diabetes Association target goal of HbA_{1c} of 7.0%. There were 56% of female subjects aged ≥40. Only 4% of patients were aged <40. In 72% of patients, the duration of diabetes was less than 10 years. Body mass index (BMI) greater than 30 kg/m² was only recorded in female patients, and HbA_{1c} <7% in 36% of study patients. The mean

HbA_{1c} level was 8.0% in diabetic patients and 4.99% in control subjects. The mean HbA_{1c} level was 7.4% (SD=1.48) and 8.7% (SD=2.57) in female and male patients, respectively. The mean (±SD) fasting plasma glucose was 4.93±1.09 mmol/L in control subjects and 8.5±4.2 mmol/L in diabetic patients. In conclusion, the quality of care in our health care facility (with 36% of our patients achieving HbA_{1c} target level of <7%) was comparable to that in western countries. However, there is considerable room for improvement. Furthermore, diabetics in our environment with the mean HbA_{1c} level of 8.0% are prone to developing complications.

INTRODUCTION

The University of Ilorin Teaching Hospital is a tertiary health care facility located in Ilorin; it provides specialist health care services to the entire Middle Belt Region of Nigeria. In this hospital, diabetes mellitus (DM) is diagnosed according to the World Health Organization (WHO) criteria (1), with subsequent amendments (2). We classify DM either as type 1 DM, type 2 DM, gestational DM or other specific types of diabetes due to other causes. Considering the wide catchment area that we cover with our diabetic care services, there was a need to assess the quality of care offered to our patients.

Corresponding author: Simeon Adelani Adebisi, FMCPATH, Department of Chemical Pathology and Immunology, Faculty of Basic Medical Sciences, College of Health Sciences, University of Ilorin, PMB 1515, Ilorin, Nigeria
E-mail: simeonadebisi2003@yahoo.com

The measurement of glycosylated hemoglobin (HbA_{1c}) in our patients is clinically important, since it provides a useful tool in monitoring long-term glucose regulation in individuals with DM (3,4). Also, it has been reported that HbA_{1c} level correlates strongly with many complications seen in diabetic patients (5). The availability of HbA_{1c} result at the time of patient's visit (point-of-care testing) has been reported to result in improved frequency of therapy intensification and improvement in glycemic control (6,7).

The UK Prospective Diabetes Study Group concluded that in patients with type 2 diabetes, the risk of diabetic complications was strongly associated with previous hyperglycemia. Any reduction in HbA_{1c} is likely to reduce the risk of complications, with the lowest risk being in those with HbA_{1c} levels within the normal range (8). By performing an HbA_{1c} test, health care providers can measure the patient's average glycemia over the preceding 2-3 months (9), and thus assess treatment efficacy. It has been suggested that HbA_{1c} testing should be performed routinely in all DM patients, firstly to document the degree of glycemic control at initial assessment and then as part of continuing care (10). Since the HbA_{1c} test reflects the mean glycemia over the preceding 2-3 months, its measurement approximately every 3 months is required to determine whether the patient's metabolic regulation has been reached and maintained within the target range. Thus, regular HbA_{1c} testing permits detection of departures from the target in a timely fashion.

Measurement of HbA_{1c} becomes very useful, knowing that sustained hyperglycemia is the single most important risk factor for the development of diabetic complications (11). An additional advantage of HbA_{1c} measurement is that the value is free of day-to-day glucose fluctuations and unaffected by exercise or recent food ingestion (3). Glycemic control is best judged by the current HbA_{1c} result (9).

At our institution for patient care, glycemic control assessment is based solely on plasma glucose measurement. It is known to be limited by the problems mentioned above. This study was carried out to assess the quality of diabetic care at our health care facility by determining the glycemic control status in

our patients with type 2 DM through determination of their HbA_{1c} level. At the same time, it was an opportunity to estimate the level of glucose control in our patients, based on the monitoring system that relies exclusively on fasting plasma glucose measurement.

PATIENTS AND METHOD

Five hundred patients diagnosed with type 2 DM and attending Diabetic Clinic at Ilorin University Teaching Hospital were recruited for this study by simple random sampling. For each clinic day, the folders (using personal identification hospital number) of the patients to be seen were serially numbered based on their arrival time. Each number was cut out and the paper folded. A neutral person was then asked to pick from the folded numbers a total number equal to forty percent of the patients to be seen that day. All the patients selected were on oral hypoglycemic agents glibenclamide and metformin. Those with treatment history less than six months were excluded. Those with a history suggestive of a hemolytic disorder (like sickle cell anemia) or any known condition with shortened red blood cell survival were excluded.

The recruited patients had their age, sex, disease duration, type of treatment for hyperglycemia, weight (kg), height (m) and body mass index (BMI) recorded. These patients were fasted overnight (between 10 p.m. and 8 a.m.), after which 6 mL blood was collected from each of them between 8.00 and 9.00 a.m. The collected blood was put in heparinized sample bottles and stored in a refrigerator at a temperature of 4 °C until assayed for HbA_{1c} level on the next day.

To estimate percentage HbA_{1c}, the ion-exchange temperature-independent chromatographic method using microcolumns as developed by Biosystems Company (Spain) was used (12,13).

Three hundred and sixty-three age-matched controls were randomly selected among the University of Ilorin staff members using the stratified random sampling method. To accommodate the interest of those patients that were seventy years and above, we included our staff members that were on contract appointment (these are people that had retired earlier by reason of

Table 1. Baseline characteristics and descriptive analysis of study patients and control subjects

	Age (yrs)		Weight (kg)		Height (m)		HbA _{1c} %	
	Diabetic	Control	Diabetic	Control	Diabetic	Control	Diabetic	Control
Mean	54.4	47.3	74.7	65.7	1.65	1.65	8.01	4.99
SD	12.9	15.12	15.79	3.98	0.07	0.06	2.15	0.85
Range	21-78	24-70	48-120	58-70	1.55-1.78	1.56-1.70	4.3-13.6	3.4-6.55

Table 2. Age and sex distribution of study patients and control subjects

Age group (yrs)	Male (n)		Female (n)		Total		% of total	
	Diabetic	Control	Diabetic	Control	Diabetic	Control	Diabetic	Control
20-29	20	-	-	37	20	37	4.0	10.2
30-39	-	29	-	43	-	72	0.0	19.8
40-49	60	37	80	72	140	109	28.0	30.0
50-59	40	-	160	-	200	0	40.0	0
60-69	40	73	-	37	40	110	8.0	30.3
≥70	60	35	40	-	100	35	20.0	9.7
Total	220	174	280	189	500	363	100	100

age or length of service but whose services were still needed and were thus reengaged as contract staff). Those found to be diabetic, or with a history suggestive of a hemolytic disorder (like sickle cell anemia) or any known condition with shortened red blood cell survival were excluded. Also recent blood transfusion was an added exclusion criterion. In control group, blood samples were collected and analyzed for HbA_{1c} as in the patient group. At a point during data analysis, study patients were stratified into age groups by decade intervals, from 20 to ≥70. They were also divided according to sex and DM duration.

We identified those patients with HbA_{1c} level below 7% (10), in line with the American Diabetes Association (ADA) Standard of Medical Care in Diabetes Mellitus.

Data analysis

Statistical analysis was done using the Epi-info software package version 6.03. Preconditions for parametric testing and description by means of arithmetic mean and standard deviation (SD) were studied and found appropriate. Descriptive statistics such as the mean and SD were calculated to compare characteristics between different categories. Student's t-test was used to determine the level of relationship between two mean values. The level of statistical significance was set at $P < 0.05$.

RESULTS

The study included 500 type 2 DM patients and 363 control subjects. Table 1 illustrates descriptive analysis of data obtained in patient and control groups. The mean HbA_{1c} level was 8.01% and 4.99%; mean height 1.65 m (SD=0.072) and 1.65 m (SD=0.059); mean weight 74.7 kg and 65.7 kg; and mean age 54.4 (range 21-78) years and 47.3 (range 24-70) years in the patient and control group, respectively.

As shown in Table 2, 56% of the study populations were females and 44% males. The great majority of patients (>90%) were aged over 40 and only 4% were below 40. On the other hand, Table 3 shows that about 72% of study patients had suffered from type 2 DM for less than 10 years; 64% of them had been diabetic for less than 5 years. Only ten (2.0%) patients had had diabetes for more than 25 years. All patients that had suffered from diabetes for ≥15 years were females.

BMI results revealed 72 (36%) male and 192 (64%) female patients to be overweight, indicating a higher tendency to obesity in female patients. Only female patients had BMI greater than 30 kg/m². Most patients in the 20-25 age group had normal BMI with a mean of 23.44 kg/m².

Except for the 20-29 and 60-69 age groups, in all other patient age groups the mean HbA_{1c} was greater than 7.0%. However, analysis of variance (ANOVA) performed for various mean HbA_{1c} values in different

Table 3. Distribution of study patients according to sex and duration of diabetes mellitus

Diabetes duration (yrs)	Male (n)	Female (n)	Total	% of total
<5	140	180	320	64.0
5-9	20	20	40	8.0
10-14	40	-	40	8.0
15-19	-	40	40	8.0
20-24	-	50	50	10.0
25+	-	10	10	2.0
Total	200	300	500	100.0

age groups yielded no statistically significant difference ($P=0.894$). The mean HbA_{1c} was 8.0% in the patient group and 4.99% in the control group. HbA_{1c} greater than 7% was recorded in 64% of diabetic patients, i.e. in 64.5% of female and 64.0% of male diabetics. The mean HbA_{1c} level was 7.4% (SD=1.48) in female diabetic patients and 5.44% (SD=0.65) in female control subjects. Similarly, the mean HbA_{1c} level was 8.7% (SD=2.57) and 4.53% (SD=0.259) in male DM patients and control subjects, respectively.

Control subjects had a mean (\pm SD) fasting blood glucose level of 4.93 ± 1.09 mmol/L and the respective value in diabetic patients was 8.6 ± 4.3 mmol/L. A strong positive correlation was found between fasting blood glucose and glycated hemoglobin levels in DM patients ($r=0.93$).

DISCUSSION

The average age characteristics of Ilorin diabetics included in this study were comparable to those reported by Nabeel *et al.* (14) and Hassan *et al.* (15). There was a female predominance in our study population (56% vs. 44%), as also reported by other researchers (14,16). The plausible reason for this sex pattern is that there is an increased frequency of clinic attendance by female than male individuals (15). Also, the fact that in most developing countries men are bread winners could account for their poor availability for clinic attendance. Most of our patients (>90%) were over age 40 and only 4% below 40, which is similar to a report from another third world country (16). This is also in line with the general opinion that type 2 diabetes is mostly a maturity onset disease.

Considering DM duration, 72% of our patients had had diabetes for less than 10 years. In a similar report (16), 71% of diabetics had the disease for less than 10 years. Another study (14) showed 77% of patients to have suffered from diabetes for less than 10 years. The reason for the high percentage of patients with less than 10-year disease duration is that either diabetes is associated with recent changes in dietary habits and lifestyle modifications, or it is a reflection of a high patient mortality (15). Ilorin as a rapidly growing urban center in a third world country (Nigeria) could easily fit in the first reason for the high percentage of patients with short disease duration. This observation could also result from the relatively low life expectancy in Nigeria, coupled with the fact that the majority of patients were aged over 40.

In our patients, the mean HbA_{1c} level was 8.0%, obviously exceeding 7.% as the level above which the development of diabetic complications is more likely (11,14,15). Only 36% of our patients had HbA_{1c} level <7%, which is comparable with reports from the western world (10,17). Saydah *et al.* report that only 37% of adults diagnosed with type 2 DM achieved an HbA_{1c} level <7% (17). In one of the studies mentioned above (14), the mean HbA_{1c} was 9.5% (15). Akbar (18) from Saudi Arabia noted that 67% of their diabetic patients had poorly controlled blood glucose; poor glycemic control was defined by $HbA_{1c} > 7.0\%$.

In various studies, poor glycemic control has been associated with an increased predisposition to worsened morbidity and mortality. In a Finnish study (19), it was discovered that glycated hemoglobin was the most important single risk factor associated with coronary heart disease (CHD) death or all coronary heart disease events. Furthermore, even after

adjustments for other cardiovascular risk factors, HbA_{1c} was still significantly associated with CHD death.

The mean HbA_{1c} level of 8.0% recorded in our study was significantly higher than either target level of 7.0% or control mean level of 4.99% ($P=0.0001$). This further supports the opinion that the high level found in patient group was due to their diabetes and not the result of the general population characteristics in this environment. Also, it adds strength to the need to do more for our patients in terms of their glycemetic control. When the mean values were compared according to sex, significant differences were still maintained.

Microalbuminuria and macroalbuminuria have been shown to be frequently associated with increased glycosylated hemoglobin values (20). Hashimoto *et al.* (5) from Japan found the prevalence of proteinuria to rise significantly with HbA_{1c} increase. In another study, it was suggested that the absence of albuminuria after 20 years or more of diabetes duration was associated with low HbA_{1c} (21). Glycosylated hemoglobin has also been linked with ophthalmic diseases. Leske *et al.* (22) showed HbA_{1c} to be positively associated with cortical and posterior subcapsular opacities of eye lens.

These varied adverse effects of increased glycation in diabetics might not be unrelated to the evidence that glycation itself may induce the formation of oxygen

free radicals. This has been linked to cholesterol peroxidation (16) in erythrocytes in diabetic patients and even in healthy subjects (23).

We noted that our male patients had a mean HbA_{1c} level higher (8.7%) than female patients (7.4%). Since HbA_{1c} elevation has been linked with deleterious effects, it may therefore be that complications of diabetes with possible death are more common in male patients. This could partly explain why we have more female diabetics attending outpatient clinics. Also, our finding that all patients that had suffered from diabetes for fifteen years or more were female appears to additionally support the possible association between mortality and the relatively higher HbA_{1c} level recorded in male patients. In our study, like in others (24-26), there was positive correlation between fasting blood glucose and glycosylated hemoglobin levels.

CONCLUSIONS

The quality of care in our health care facility (with 36% of our patients achieving HbA_{1c} target of <7%) is comparable to what is offered in western countries. However, there is considerable room for improvement. Furthermore, diabetics in our environment with mean HbA_{1c} level of 8.0% are prone to developing complications.

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