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Original Research Article

Diabetes Mellitus in adult Nigerians: patients' characteristics, laboratory profile, practices and management outcome

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ABSTRACT

Background: Type 2 diabetes constitutes more than 90% of cases seen in Nigeria. Previous reports had shown that patients were poorly controlled and failed to meet management target across a broad range of parameters. Objectives of this study evaluated the characteristics and practices of patients attending the outpatient diabetes clinic. The study also examined to what extent they achieved management goals and what practices by the patients impacted negatively on treatment outcome.
Methods: This was a cross sectional descriptive study. All patients were eligible. Consecutive patients attending the Diabetes Clinic were evaluated. Their demographic, behavioural, social, clinical and laboratory data were obtained. Data analysis was done with SPSS V 21.
Results: There were 193 subjects, 78 males and 115 females aged 35-82(59.8± 9.1) years. T2DM was diagnosed in 93.4%. Hypertension was coexistent in 74%. Present or past foot ulcer was recorded in 11.9%. Only 37% of the subjects had an exercise program, 35% did the daily foot exam, and 45% had ophthalmology consult. Skipping medication was widespread (64%), mainly due to self-titration of medications (44%) and cost (23%). Fear of hypoglycemia (83%) and hypotension (79%) was prevalent. Their body mass index was 18.2-41.2(27.6±4.8) kg/m2. Subjects were prescribed a total of 2-14 medications (5.5±1.6). Metformin was the most commonly used glucose lowering medication (88.6%), followed by sulfonylureas (64%) and insulin (27.5%). HbA1c ranged from 5.3-16; 9.0±2.4%(33-151; 75±2.7 mmol/mol).
Conclusion: Glycaemic control was poor in the study population. Intermittent medication to avoid hypoglycemia played a major role. The patients lacked competence to manage their diabetes from day to day. Diabetes Self-Management Education and Support (DSMES) and early use of insulin are recommended.

Keywords: Adherence, Competence, Control, Diabetes mellitus, Profile

INTRODUCTION

Diabetes mellitus (DM) is one of the four growing pandemic non-communicable diseases (NCD) ravaging the modern world according to the WHO global report on Diabetes.[1] The prevalence of the disease has been rising globally especially in low and middle income countries (LMIC). The 2016 estimate for the prevalence of diabetes in Nigeria by the World Health Organization (WHO) was 4.3%.[2] Local studies estimate the prevalence to range from 0.8% to 11% between rural and urban populations.[3,4] The predominant type of DM in Nigeria is Type 2 (T2DM), accounting for about 90%-95% of all cases.[4,5] The WHO Assessment of the national response to diabetes (Nigeria) in 2016 revealed that policies, guidelines and monitoring were only partially

implemented.[2] A Profile of Nigerians with diabetes mellitus carried out in 2008 by Diabecare Nigeria study group concluded that most Nigerian diabetic patients had suboptimal glycemic and blood pressure control and had developed chronic complications of diabetes.[6] Less than 10% of patients with diabetes in Nigeria are covered by any kind of medical insurance.[4] Skipping hospital appointments, borrowing or selling assets were some of the strategies engaged to meet with the cost of treatment.[7,8]

As a result of the high cost of treatment, ethnomedical and alternative healing systems constitute primary and complementary health care for most Nigerians as in other African populations.[4,5,9,10] Poor adherence to prescribed interventions also negatively impact disease outcome.[11]

METHODS

The study was observational and cross sectional. It was undertaken over a six month period. The Diabetes Clinic caters exclusively to adult patients diagnosed with DM. Diagnosis of T2DM was based on standard criteria. T1DM were those who were less those 40 years at diagnosis and required insulin from the outset for control of the disease and were on insulin at the time of assessment.

All patients with diabetes were eligible for the study. Consecutive patients attending the outpatient clinic were interviewed by the authors using a structured questionnaire. Their demographic, behavioural, social, clinical and laboratory data were obtained. They were assessed for DM type and treatment, coexistent hypertension, smoking and alcohol consumption, history of foot ulcer or surgery, level of ambulation, exercise program, diabetic health education, self-foot examination, eye consult, pill burden, medication compliance and fear of hypoglycemia and hypotension. Anthropometric measurements; weight, height, waist circumference (WC), hip circumference (HC) and waist hip ratio (WHR) were recorded. Laboratory data (A1C, fasting lipid profile and serum urea and creatinine) were also recorded. Data was analysed with SPSS V 21 21 (SPSS, Inc, Chicago, IL, USA). Descriptive statistics was used to describe the data and the results presented as frequency tables and pie charts. Bivariate cross tabulations to identify important associations between variables were done using Chi-square statistics and Pearson's correlation. A P-value of <0.05 was considered statistically significant.

RESULTS

Demographics

There were 193 subjects, 78 males and 115 females with a ratio of 1:1.5 (Table 1). They were aged 35-82 (59.8±9.1) years. The ages of the males and females were comparative (p = 0.293). Most of the patients were of Igbo ethnic group (97%).

The majority were married (79%); 16.4% were widowed, while single and divorced persons constituted 4.2% of the population. In terms of education, more than 90% had some level of formal education and were literate Their occupation was varied constituting mainly of trade and craft related occupations, 38%', elementary occupations, 18%; retired individuals, 11%; technical and associate professionals, 10%; clerical and support staff, 10%; while service and sales personal, unemployed and professionals made up the rest. Most of the patients had given up drinking alcohol and smoking cigarettes with the onset of diabetes. Less than 1% of the subjects still smoked and only 8% took alcohol. Alcohol consumption was rated as only occasional in those who used it and the types of alcohol used were beer, stout and local palm wine (Table 1).

Table 1: Age, gender, smoking and alcohol use.

Variable	Male		Female		Total		P-value
	n	%	n	%	n	%	
Sex	78	40.4%	115	59.6%	193	100%	
Age (years)	38-81 (62.0 ±9.4)		35-82 (58.3±8.7)		35-82 (59.8± 9.1)		0.293
Smoking past	25	41.0%	0	0.0%	25	18.8%	
Smoking now	1	1.9%	0	0.0%	1	0.8%	
Alcohol past	53	73.6%	41	47.7%	94	59.5%	
Alcohol mow	8	14.5%	2	2.8%	10	7.9%	

DM and Hypertension

Type 2 diabetes mellitus (T2DM) was diagnosed in 93.4% and Type 1 (T1DM) in 5.7% of the subjects (Table 2). Only one person was on diet alone, 71% were on oral glucose lowering oral medications and 28% required insulin. Hypertension was coexistent in 74%. Females significantly had a longer duration of hypertension than the males (p =0.002). Diabetic foot disease (chronic foot ulcer past or present) was identified in 11.9% of the subjects (Table 2).

Ambulation and exercise

Their most frequent waking position was sitting down (82%). Ambulation was independent in 86% and needed assistance in the rest. Ambulation distance was unlimited in 75% and limited to community or the home in 24%. Only 37% of the subjects had an exercise program. Exercise was low impact in all cases (Table 3).

Diabetes education and preventive measures

Most of the subjects received diabetes health education (92%) Only 40% of subjects examined their feet daily. Dilated eye examination occurred in 48% (Table 4).

Table 2: Pattern of diabetes, hypertension and foot disease.

Variable	Male		Female		Total		p-value
	n	%	n	%	n	%	
DM duration	1-27 (10.1±6.6)		1-35 (9.8±6.9)		1-35 (9.9±6.8)		0.773
DM Type							0.726
DM Type 1	5	6.4%	6	5.2%	11	5.7%	
DM Type 2	73	93.6%	109	94.8%	182	94.3%	
DM treatment							0.582
Diet only	0	0.0%	1	0.9%	1	0.5%	
+Oral medication	58	74.4%	80	69.6%	138	71.5%	
++ Required insulin	20	25.6%	34	29.6%	54	28.0%	
Hypertension	51	68.0%	88	77.2%	139	73.5%	0.161
Hypertension Duration	1-20 (5.3± 4.6)		1-40 (12.6±9.6)		1-40 (10.2±9.0)		0.002
Foot ulcer	9	11.5%	15	13%	24	11.9%	0.223

Table 3: Level of ambulation and activity.

Variable	Male		Female		Total		p-value
	n	%	n	%	n	%	
Most frequent waking position							0.307
Sitting	55	78.6%	88	84.6%	143	82.2%	
Standing/walking	15	21.4%	16	15.4%	31	17.8%	
Ambulation							0.452
Independent	67	87.0%	98	85.2%	165	85.9%	
♦WAA	8	10.4%	15	13.0%	23	12.0%	
*SBA	1	1.3%	1	0.9%	2	1.0%	
Assist	1	1.3	1	0.9%	2	1.0%	
Ambulation Distance							0.512
Unlimited	62	79.5%	83	72.2%	145	75.1	
Limited to community	12	15.4%	26	22.6%	38	19.7	
Homebound	4	5.1%	5	4.3%	9	4.7%	
Non-ambulatory	0	0.0%	1	0.9%	1	0.5%	
Exercise	25	34.2%	41	38.7%	66	36.9%	0.546

♦WAA-with ambulatory aids, *SBA-stand by assist

Table 4: Status of diabetic health education, feet and dilated eye exam of subjects.

Variable	Male		Female		Total		p-value
	n	%	n	%	n	%	
Diabetes health talk	64	91.4%	97	92.4%	161	92.0	0.820
Daily feet examination	30	41.7%	41	38.7%	71	39.9%	0.690
Dilated eye examination	37	47.4%	55	47.8%	92	47.7%	0.471

Medication adherence and fear of the "hypos"

How they habitually used medication was examined. Skipping medication was widespread and was recorded in 64% of patients (Table 5). The attributable causes are shown in Table 5 and Figure 1. Titration or sliding scale means patients intentionally interrupted treatment to prevent the occurrence of hypoglycemia. Attitude problems included those patients who were fed up with their medication or who gave themselves drug holidays. There is a prevailing opinion that taking medications continually was unhealthy and such patients took a break from time to time. Cost issues were those who were unable to meet with the became medications and ran out pending when funds ecame available. Cost issues also arose when patient are prescribed expensive brands or expensive class of drugs. Some patients chose a less expensive drug (glyburide) when a more expensive one was prescribed (egincretin) without the prescribers knowledge. Administrative issues were in those patients due to their work scheduling or domestic issues were obliged to forgo doses of their medicine for example leaving for work or market at the stroke of dawn. Assessing which aspect of the illness they feared most or perceived as dangerous (could kill immediately) the subjects reported hypoglycemia (83%) and hypotension (79%); Table 5.

Table 5: Pattern of skipping of medication and fear of the "hypos".

Variable	Male		Female		Total		p-value
	n	%	n	%	n	%	
Skipping medications	49	62%	76	65.5%	124	64.2%	0.806
Reasons for skipping							0.208
Attitude	5	10.2%	1	1.3%	6	4.8%	
Self-titration	23	46.9%	32	42.1%	55	44.0%	
Financial	10	20.4%	20	26.3%	30	24.0%	
Administrative	5	10.2%	14	18.4%	19	15.2%	
Others	3	6.1%	4	5.3%	7	5.6%	
Titration and cost	3	6.1%	5	6.6%	8	6.4%	
Fear of "hypos"							
Hypoglycemia	47	78.3%	84	86.6%	131	83.4%	0.176
Hypotension	38	71.7%	76	83.5%	114	79.2%	0.092

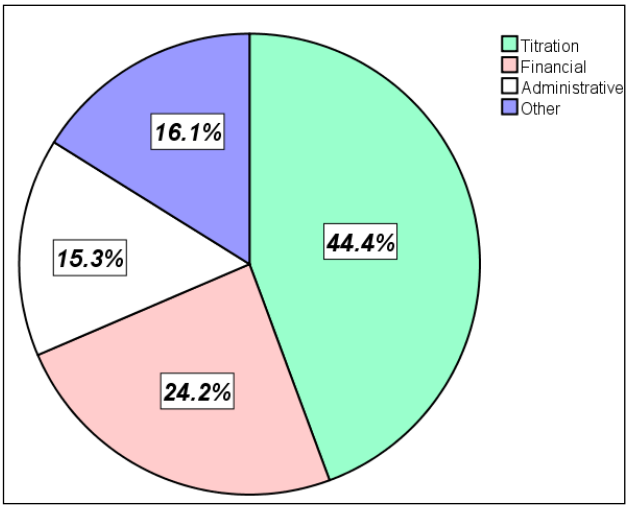


Figure 1: Reasons for skipping medication.

Medications

All the patients were on glucose lowering medications except one who was on diet alone. Subjects were prescribed a total of 2-14 medications (5.5±1.6). Metformin was the most commonly used drug (88.6%), followed by sulfonylureas (64%) and insulin (27.5%). Glyburide constituted 54.3% of all sulfonylureas followed by glimepiride (15.4%), while glypizide and gliclazide were prescribed in 5.4%. Insulin was used as intensive or add-on therapy in 27.5% of patients, consisting of premix insulin (70/30 insulin) in 15.5% and insulin glargine in 8%. The incretins were scarcely prescribed due to cost. Combination therapy with two oral hypoglycemic agents (OHA) was the most common (56%); one OHA and insulin (70/30) combination in (15%); two OHA and insulin (glargine) in 8% and three OHA combination in 2%. Single therapy with metformin was used in 13% % and insulin (70/30) alone in 3% of the subjects.Angiotensin converting enzyme inhibitors and angiotensin receptor blockers (ACEI/ARBS) were prescribed in 71.5% of subjects (Losartan, 42%; Lisinopril, 16% and Telmisartan, 8%). The main additional anti-hypertensive agents used were hydrochlorothiazide (HCTZ) in 35% and amlodipine in 19%. Statins were infrequently used (10%). Low dose aspirin was prescribed in 58.5%. Clopidogrel was infrequently prescribed. Drugs for diabetic peripheral neuropathy were prescribed in 9.6% (pregabalin, gabapentin, and carbamazepine). Other drugs prescribed

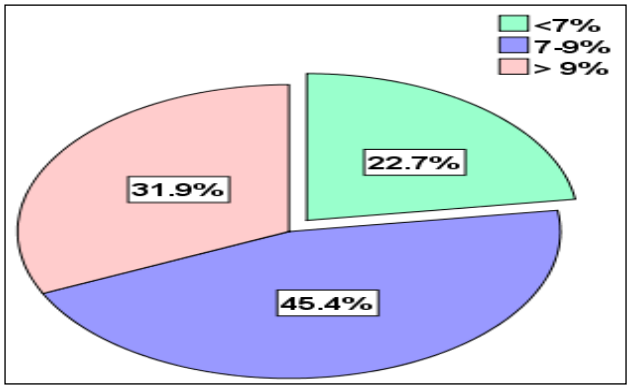
included a motley of various medications; antioxidants, multi-vitamins, non-steroidal anti-inflammatory drugs (NSAIDS), analgesics and antibiotics in 46%.

Anthropometric measurements

The anthropometric parameters are shown in Table 6.When the WHO cut off points were applied, BMI was >25 kg/m2 in 60% (52% of males and 78% of females). About 3% of females recorded a BMI of >40 kg/m2, but none in males. The WC was >102 cm in 29% of males and >88cm in 78% of females. The WHR was >1.0 in 32% of males and >0.85 in 79% of females. BMI, WC and WHR were significantly higher for females than males ($p \leq 0.002$, $p \leq 0.001$, and $p \leq 0.003$ respectively; Table 6). On the average, target measurements were met in only 37% for BMI, 42% for WC and 51% for WHR.

Laboratory data

HbA1c values ranged between 5.3-16 % (9.0±2.4). The difference between the values in males and females was not significant (p=0.764). Target values for HbA1C (<7%) were met only in 22% (Table 6 and Figure 2). There was no significant correlation between HbA1C values and other variables examined except for duration of diabetes ($p \leq 0.001$) and skipping medication ($p \leq 0.002$). The values for the lipid parameters are also shown in Table 6.



(7% = 53 mmol/mol; 9% = 75mmol/mol)

Figure 2: Distribution of HbA1C values in the study subjects.

Table 6: Anthropometric measurements and laboratory values.

Variables	Male	Female	Total	p-value
BMI	18.2-35.6 25.6±4.8	18.9-41.2 28.9±4.0	18.2-41.2 27.6±4.8	0.002
WC (cm)	73-116 93.7±10.5	66-126 98.1±11.1	66-126 96.96.2±11	0.001
WHR	0.83-1.17, 0.97± 0.07	0.61-1.12, 0.94 ± 0.08	0.61-1.17, 0.95 ± 0.08	0.003
HbA1C (%)	5.3-15, 9.1±2.5	5.8-16, 8.9 ±2.3	5.3-16, 9.0±2.4	0.764
(mmol/mol)	34.4-150.3, 75.9±3.8	39.9-151.4, 73.8±1.6	34.4-151.4, 74.9±2.	
TChol (mmol/l)	2.7-8.9 4.9±1.3	2.3-9.3 5.4±1.3	2.3-9.3 5.2±1.3	0.046
HDLC (mmol/l)	0.5-2.7 1.3±0.5	0.6-2.4 1.5±0.6	0.5-2.7 1.4±1.2	0.001
LDLC (mmol/l)	0.2-6.6 3.0±1.3	0.6-6.6 3.2±1.2	0.2-6.6 3.1±1.2	0.994
TG (mmol/l)	0.3-2.9 1.3±0.6	0.5-2.4 1.2±0.5	0.3-2.9 1.3±0.5	0.021
Non HDLC (mmol/l)	0.5-6.7 3.5±1.2	0.8-7.3 3.9±1.3	0.5-7.3 3.8±1.3	0.342
TChol/HDL	1.2-12.2 4.2±1.9	1.5-9.4 3.9±1.6	1.2-12.2 4.0±1.7	0.141
LDL/HDL	0.1-10.8 2.9±1.7	0.4-6.4 2.3±1.2	0.1-10.8 2.6±1.5	0.090
TG/HDL	0.2-3.7 1.3±O.8	0.3-3.5 1.0±0.7	0.1-2.7 1.1±0.4	0.447
Urea mmol/l	2-19.6, 5.8±3.1	2-15 5.0±2.5	2-19.6, 5.3±2.8	0.061
Creatinine µmol/l,	39-583 134.2±94.9	37-256, 96.7±39.2	37-419, 107.9±69.7	0.193

BMI-body mass index, WC-waist circumference, WHR-waist hip ratio, HbA1C-glycated hemoglobin, TChol-total cholesterol, HDLC-high density lipoprotein cholesterol, LDLC- low density lipoprotein cholesterol, TG-triglyceride. Highlighted values are statistically significant.

TChol and HDLC levels were significantly higher in females than males (p ≤0.046 and ≤0.001 respectively) while TG levels were higher in males (p ≤ 0.021). Target values for TChol (<5.2 mmol/L) were thus met in 54.4%, HDL (>1.0 mmol/L in males and 1.3 in females) in 56.8%, LDL (<2.6 mmol/L) in 32.8%, TG (1.7mmol/L) in 81.6% and Non-HDLC (<3.3) in 36.8%. Considering the lipid ratios, TChol/HDLC was (<3.5 males and 3.0 females) in 42.4%, LDLC/HDLC <2.5 in 74.4% and TG/HDLC <2.0 in 86.3%. Serum creatinine levels were >110 in 31% (26% of males and 35% of females).

DISCUSSION

Age and gender

The age range of the patients is consistent with what has been observed in other studies.[4-6,10,12] Gender distribution showed a female preponderance in the study population. This agrees with several other local studies that revealed higher female ratio in different proportions.[6,10,12] The male bias has been ascribed to cultural, geographic, and socioeconomic factors rather than mere gender related prevalence of DM.[12]

Hypertension and diabetes

Hypertension is a common co-morbidity with diabetes. The prevalence depends on type and duration of diabetes, age, sex, race/ethnicity, BMI, level of glycemic control, and the presence of kidney disease, most local studies demonstrate this association.[4,6,10,12-15] These studies also reveal that dyslipidemia and hypertension were the most common co-morbidities in diabetic patients. Since hypertension is a strong risk factor for atherosclerotic cardiovascular disease (ASCVD), heart failure, and microvascular complications, this further complicates the plight of the patient with diabetes especially for poorly controlled populations.[13]

Ambulation and exercise

For decades, exercise, diet and medications have been the cornerstone of diabetes management. The benefits of physical activity and exercise in diabetics are unquestionable.[16] However, regular exercise is not often adopted by the majority of the DM population. In the series by Darteet al, only a third of the patients (38.8%) exercised. The figure for the Nigerian Diabcare group was 39.5% 6 and for this study 37%.[17] It is to be observed that trade and craft related, elementary occupations and retired individuals which made up 64% of this study population considered their work related activities (farm work, walking to their workplace or market and practice of their craft) were sufficient exercise and so had no need for extra exercise. Most of the patients spent the major part of their waking hours sitting or lying down (82%). Various studies offered several explanations for this including impaired physical fitness by Win de Grauw et al, and abnormal balance and mobility by Cordeiro et al. Studies by Edwardson et al, and Henson et al, demonstrated that breaking up prolonged sitting with bouts of standing or walking improved markers of cardio-metabolic health.[18-21] However, mobility presents unique problems in patients at risk of developing foot ulcers due to the high cumulative plantar stress associated with standing and walking.[22] These mitigating factors contribute to patients' unwillingness to be more active as was seen in this and many studies. These factors need to be addressed when developing exercise programs for DM patients. Breaking up prolonged sitting with 5-min bouts of standing or walking at a self-perceived light intensity is a good practical measure to adopt for most patients.

Education, preventive measures and diabetic foot disease

Global prevalence of diabetic foot is 6.3% and for the Africa Region. 11%.[23,24] Diabetic foot disease is a major cause of non-traumatic lower extremity amputation worldwide. Diabetes is also the leading cause of new cases of blindness in adults. Only 40% of patients in this study examined their feet daily and 37% had dilated eye examination. Lack of referral and disaggregation of care services may have discouraged patients seeing the eye physician. However, there is no satisfactory explanation for lack of foot examination. Health education and knowledge may translate into positive action if the subjects see themselves as vulnerable and the condition as threatening, are convinced of the health behaviour efficacy, and find few barriers to the action.[25]Diabetic foot disease (DFD) is more prevalent in males.[23]The current study found DFD in 11.9% with no significant difference between males and females. DFD accounted for 11.7% of diabetes admissions by Ogbera et al, 16.0% by the Diabcare Nigeria study groupand 16.4% by Young et al.[6,26,27] The presence of DFD is a poor prognostic feature in DM. The five-year mortality rates after new-onset diabetic ulceration have been reported as between 43% and 55% and up to 74% for patients with lower-extremity amputation.[28] This is generally associated with high prevalence of advanced microangiopathic and macroangiopathic comorbidities that lead to high morbidity and mortality.[29]

Fear of the "hyopos"

Fear of hypoglycemia (FOH) is a widespread phenomenon among diabetic patients and has a significant negative impact on diabetes management, metabolic control and subsequent outcomes.[30] Hypoglycemia as a life threatening condition was reported in 83% of the subjects. Similarly, hypotension perhaps by association of terms is also seen as life threatening and can result in a stroke event. What the patients often did was to take proactive avoidance action never to fall victim; namely withdrawal of medication as their blood glucose and blood pressures drop towards normal values.

Medication adherence

Medication adherence refers to the extent to which a person's behaviour – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider Poor adherence to treatment of chronic diseases is a worldwide problem of striking magnitude.[11]Adherence to long-term therapy for chronic illnesses in developed countries averages 50% but is even lower in developing countries.[11] The consequences of poor adherence to long-term therapies are poor health outcomes and increased health care costs. Studies in Nigeria produced medication non-adherence rates as high as 68% by Raimi, 52% by Muhammed,50% by Jackson and in this study 64%. The reasons given for failure of adherence were usually lack of funds and cost of medication, forgetfulness, feeling well, non-availability of drugs at the pharmacy, side effects of medications, limited access to care, complexity of regimen and others.[4,31-35] However, what was revealing in this study was that fear of hypoglycemia (FOH) played a major role. FOH as a major contributor was noted by Nwaokoro.[35]

Patients determined glycemic set points as high as 150 mg/dl at which level they withdrew medication to resume when the blood glucose rose again. For persons who tested their blood glucose infrequently, they had to wait for that next blood test to resume medication or when they started experiencing symptoms. Healthcare providers are unaware of this patient self-determined management policy. These patients did not see themselves as non-adherent to medications; they were just being careful. To the question, 'Are you taking your medications as prescribed? The answer will be 'Yes". However, when you ask, "what do you do when your blood glucose starts dropping to normal levels? The answer becomes, "Stop medication". There is much emphasis on how to recognize hypoglycemia and steps to prevent and treat it, but little information is given to patients on a graded step down approach to their medications when blood glucose begins to drop to normal level which is the goal of therapy. Patients now see near normal blood glucose levels (and blood pressure levels) as a prelude to the 'hypos' and therefore threatening.

Anthropometric measurements

Body mass index has a strong relationship to insulin resistance and diabetes. As abdominal fat mass, waist circumference, and waist-to-hip circumference ratio increase, so does the risk for developing type 2 diabetes mellitus (T2DM).[1,36] The average BMI of 27.6±4.8 was similar to the finding of other authors on the subject in Nigeria; 27.2±5.4 by Diabecare Nigeria and 28.7 by Okafor et al, as was well as the other indices of central adiposity; WC and WHR.[6,14,37] In addition, a study by Oli et al, on basal insulin secretion in Nigerian T2DM, found WC measurement as the most consistent, simple anthropometric parameter that correlated and predicted insulin resistance (IR) in their study patients.[38]

Medications

The number of prescribed drugs is high in people with diabetes mellitus especially the elderly due to coexistent comorbidities, complications and medication side effects.[39] People with T2DMwere prescribed 8.4±3.0 different drug compounds per day (maximum, 16) in a report by Bauer et al. Polypharmacy refers to the use of ≥5 medications, but may be clinically appropriate using current guidelines.[40,41] Polypharmacy subjects the patient to higher costs, higher prevalence of adverse drug reactions, reduced adherence, lower quality of life, higher risk of hospitalization and even death.[39] In this study, patients were prescribed as many as 14 medications with an average of 5.5. Drugs for peripheral neuropathy, antioxidants, multivitamins and supplements were frequently prescribed in a bid to ameliorate symptoms and disease progression with uncertain benefit.[42,43] Rational use of drugs is necessary to prevent drug therapy problems of diabetes. All medications should be evaluated for appropriateness, effectiveness, safety and compliance.[44]

Glycemic control

HbA1c has gained ground in the diagnosis and management of diabetes. It also correlates well with the risk of long-term diabetes complications.[45] Significant longitudinal associations between HbA1c levels, diabetes status and long-term cognitive dysfunction have been reported.[46] Recently published data indicate that glycemic control is suboptimal in a substantial proportion (typically 40%-60%) of people with diabetes irrespective of geographic regions and in both low- and higher-income countries.[47] This report by Blonde et al[47]blames therapeutic inertia as an important contributor to poor glycaemic control in up to half of people with type 2 diabetes. Only a 22% of our patients achieved target HbA1C level of <7%. This is a common finding in local studies.[4-6,48] Financial constraints, medication non-adherence, underutilization of insulin, diabetic duration and inadequate diabetic knowledge have been identified as significant determinants. Physician inertia is a moot point. The study by Oli et al, and Young et al, demonstrated that beta cell failure is a predominant feature in our patients with T2DM.[38,49]

Though incretins offer the option of a three OHA combination for better glycemic control, they are scarcely used due to cost. Insulin is an effective, safe and well-tolerated when the guidelines are followed and is comparatively cheaper. Improvement in insulin delivery technology with the introduction of insulin pen devices and microfine needles has mitigated some of the objections to insulin use. Current recommendations on insulin therapy in DM are very sensible. Physicians

should initiate and intensify insulin therapy as soon as needed.[50]

Lipids

Atherogenic dyslipidemia is a common co-morbidity with diabetes. Diabetes atherogenicdyslipedemia (DAD) typically consists of elevated plasma concentrations of both fasting and postprandial triglyceride-rich lipoproteins (TRLs), small dense low-density lipoprotein (sdLDL) and low high-density lipoprotein (HDL) cholesterol.[51] Local studies have consistently demonstrated the presence of DAD. The pattern of dyslipidemia was usually low HDL-C and high LDL-C. The proportion of persons with raised TG were however lower. It has also been noted that overall lipid values were low compared to Caucasian values.[4,6,52,53] The same pattern was demonstrated in this study. Even when the traditional lipid parameters are within reference values, lipoprotein rations have been found to be predictive of additional risk for the development of cardiovascular events and effectiveness of therapy. Castelli's risk index-I and II, atherogenic coefficient (AC), CholIndex and atherogenic index of plasma (AIP) have been found to correlates strongly with the incidence and extent of coronary artery disease both in men and women.[52,53]

CONCLUSION

Glycemic control was poor in the study population. There was failure to meet target across a several categories of diabetes care and management. Skipping medication to avoid hypoglycemia played a major role. While the study highlighted institutional weaknesses, it is evident that the patients lacked competence to manage their diabetes from day to day. Poor health outcome in diabetic patients attending health facilities is a big disincentive to patients depending on complementary and alternative treatment to seek biomedical treatment. It is recommended that care givers should invest in Diabetes Self-Management Education and Support (DSMES) activities in their patients. 54 Early use of insulin in deserving patients is also key to achieving desired targets.

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