

Diabetes mellitus in Nigeria: The past, present and future

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Core tip: This manuscript at best is a critical appraisal of earlier knowledge and data on diabetes mellitus (DM) in Nigeria. It also highlights the changes that have occurred in terms of prevalence and also in terms of diagnosis and management techniques. Challenges in provision of DM care and the roadmap for the future of DM care are documented in this manuscript.

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Abstract

Diabetes mellitus (DM) is a diverse group of metabolic disorders that is often associated with a high disease burden in developing countries such as Nigeria. In the early nineties, not much was known about DM in Nigeria and traditionally, people related DM to "curses" or "hexes" and diagnosis was made based on blood or urinary tests for glucose. Currently, oral hypoglycaemic agents but not insulin are readily accessible and acceptable to persons with DM. The cost of diabetes care is borne in most instances by individuals and often payment is "out of pocket"-this being a sequel of a poorly functional national health insurance scheme. An insulin requiring individual on a minimum wage would spend 29% of his monthly income on insulin. Complementary and alternative medicines are widely used by persons with DM and form an integral component of DM care. Towards reducing the burden of DM in Nigeria, we suggest that there be concerted efforts by healthcare professionals and stakeholders in the health industry to put in place preventative measures, a better functioning health insurance scheme and a structured DM program.

INTRODUCTION

Diabetes mellitus (DM) is a chronic disorder that is not only assuming pandemic proportions worldwide but also poised to affect the developing countries of the world much more than their developed counterparts. As far back as the beginning of the twentieth century, DM was described by Dr. Cook as being an uncommon disorder in the African. There is however, compelling data to show an increasing incidence and prevalence of DM in the continent^[1]. The estimated prevalence of diabetes in Africa is 1% in rural areas, and ranges from 5% to 7% in urban sub-Saharan Africa^[1].

Nigeria, with a population of 158 million people, is the most populous country in Africa and accounts for one sixth of Africa's population. Approximately 50% of Nigerians are urban dwellers and the country has a cultural diversity and 398 documented ethnic groups^[2]. Health care delivery as in most developing countries of the world is at best sub-optimal and this may be respon-

sible for the dismal health indicator statistics such as reduced life expectancy at birth and increased maternal mortality. Health care provision in Nigeria is a concurrent responsibility of the three tiers of government with private providers of health care also playing a notable role in health care delivery. Health insurance is still taking tottering steps despite having being inaugurated about two decades ago and healthcare payment is largely “out of pocket”.

In this review, we attempt to document the present and past data on DM in Nigeria, and highlight the challenges of DM care. This article aims to appraise the present status of DM in Nigeria and the roadmap for the provision of DM care for the future.

Methods

We searched MEDLINE and reference lists of literature on diabetes in Nigeria from all available years and the key words “diabetes”, “prevalence” and “Nigeria” were used. For an extended search we introduced key words like complications. The combination of key words like “heart failure”, “cardiovascular disease”, “stroke”, and “sexual dysfunction” nephropathy, and retinopathy. We also used search engines such as Google and Google scholar. The pattern of articles obtained included mainly retrospective and a few prospective studies and were largely hospital based with a few community based reports all drawn from urban and rural communities.

THE PAST

Studies that were conducted over the four decades from 1960 to 2000 showed generally low prevalence rates for diabetes in Nigeria^[3-7]. Two studies^[3,4] that were conducted in 1963 and 1971 reported prevalence of less than 1% for diabetes in Nigeria. The prevalence was still low at 0.8% to 2.8% in several studies^[5-8] that were conducted from 1988 to 1998 with most patients having non-insulin dependent (type 2) diabetes. These studies^[5-7] were limited to particular population groups in Nigeria except one^[8] which was part of a national survey that assessed the prevalence of non-communicable diseases in the entire Nigerian population. In the past, diabetes was largely categorized as juvenile onset (insulin dependent) and maturity onset (non-insulin dependent) diabetes with juvenile onset diabetes being rarely reported in the Nigerian. The rarity of juvenile onset (type 1) diabetes is underscored by a study^[9] that was done in 1990 where only 6% of 756 registered diabetes patients were aged 15 to 30 years at diagnosis. There used to be a class of diabetes referred to as malnutrition related diabetes, and this comprised of two subsets: fibrocalculous pancreatic diabetes and protein deficient diabetes^[10]. Two Nigerian studies reported prevalence rates for Malnutrition related DM of 6%^[10] and 8.6%^[4]. Malnutrition related diabetes which was typically diagnosed in nutritionally deprived populations was however, removed as a separate class of diabetes in 1997 and rather considered as one of “other specific causes of

diabetes”^[11].

As far back as 1963 temporary diabetes had been described in adult Nigerians with the phenotypic characteristics of type 2 diabetes^[12]. The term remittent DM was employed for the same phenomenon in 1978^[13]. The more recent terminologies for this phenomenon where persons with phenotypic characteristics of type 2 diabetes present with unprovoked hyperglycaemic ketoacidosis as the initial manifestation of diabetes as expected with type 1 diabetes but subsequently run a course similar to Type 2 diabetes where they are insulin independent for several years has being described as Ketosis prone type 2 diabetes^[14].

The earliest studies on the genetic contributions to the aetiology of DM in Nigeria found gene associations that are different from those reported in Caucasian populations^[15,16]. While HLA-B8 is strongly associated with insulin dependent diabetes in Caucasians, the contrary was the case in Nigerians^[15]. Another study^[16] reported a low prevalence of DR4 in Nigerians with type 1 diabetes.

A study^[17] that assessed patients’ knowledge and self care practices of diabetes found that 78% of the Study population ascribed diabetes to poisoning and that about 70% of patients checked glycaemic control by tasting urine or passing urine on the ground and observing for ants.

Treatment of DM in Nigeria has always included the administration of insulin and oral hypoglycaemic agents in conjunction with dietary counselling and life style modification. Bovine and porcine insulin were the predominant forms of insulin used in the past. The animal insulins and particularly porcine insulin had the problems of immunogenicity which mitigated against their effectiveness^[18]. Insulin treatment in the past was also complicated by the presence of various insulin concentrations and various sizes of insulin syringes namely the U40 for 40 units per milliliter vial and syringe and the U80 for the 80 units per milliliter vial as there was no proper regulation of the insulin market. There were often cases of patients getting discordant insulin vials and syringes leading to either hyperglycemia or hypoglycemia.

THE PRESENT

The current prevalence of DM in Nigeria is not known but guestimates may likely be in the region of 8%-10%. Of the four classes of DM, three types are frequently recognized in our setting and these are type 1 DM (T1DM), T2DM and gestational diabetes. Of the three types of DM, T2DM is the commonly documented form of DM and in most endocrine clinics, it accounts for about 90%-95% of all cases of DM. The prevalence of T1DM is not known but there are sketchy reports from various endocrine centres and documented prevalence rates which are all hospital based range from 0.1/1000 to 3.1/1000^[19,20]. It is pertinent to note that in our setting, clinical criteria are often used to classify patients with DM into type 1 and T2DM. These criteria include a cut

off age of thirty years and insulin requirements or usage since diagnosis. For T2DM additional clinical criteria for diagnosis include history of usage of oral hypoglycaemic agents or usage of combination of insulin and the oral hypoglycaemic agents.

Gestational diabetes refers to any degree of glucose intolerance first detected in pregnancy. Patients diagnosed with diabetes in the first trimester of pregnancy are however more likely to have pre-gestational diabetes. One Nigerian study^[21] found that gestational diabetes to occur in 2.98 per 1000 pregnancies, while another study^[22], showed that the prevalence increased with maternal age; 3.3% in the age group of 15 to 24 years, 4.2% in those aged 25 to 34 years with a spike to 17.6% in the age group of 34 to 44 years and an average prevalence of 4.2%.

Gestational diabetes is usually first tested for in persons at risk between 24 and 28 wk gestational age. Gestational diabetes can be diagnosed using fasting plasma glucose, 75 gram oral glucose tolerance test (OGTT) or 100 g OGTT. Gestational diabetes is diagnosed based on the finding of fasting blood glucose ≥ 5.1 mmol/L-6.9 mmol/L (92-125 mg/dL) or plasma glucose 2 h post 75 g OGTT of ≥ 7.8 mmol/L^[23]. Where 100 g OGTT is performed, gestational diabetes is diagnosed when at least 2 results of blood samples taken at fasting, 1, 2 or 3 h post OGTT meets the following threshold values; fasting plasma glucose ≥ 5.3 mmol/L, 1 h post OGTT ≥ 10 mmol/L, 2 h post OGTT ≥ 8.6 mmol/L and 3 h post OGTT ≥ 7.8 mmol/L^[23].

The Diabetes Association of Nigeria recommends the performance of the 75 g OGTT in pregnant work with risk factors for gestational diabetes. These risk factors are a previous history of gestational diabetes, family history of type 2 diabetes, pre-pregnancy body mass index ≥ 25 kg/m², birth of baby > 4 kg, recurrent miscarriage, still birth, neonatal death, grand multiparity, polycystic ovarian syndrome, systemic hypertension and glycosuria in index pregnancy. Patients diagnosed with gestational diabetes during pregnancy will need to be re-assessed about 6-12 wk post-delivery using fasting plasma glucose and or plasma glucose at 2 h post 75 g OGTT interpreted using criteria applicable to non-pregnant adults^[24].

For the diagnosis of DM the World Health Organization (WHO) 1999 criteria apply^[25] and the commonly used test is the fasting plasma glucose which is more pragmatically poised in the diagnosis of DM than the oral glucose tolerance test that is not readily reproducible. The use of glycosylated haemoglobin test in the diagnosis of DM was recommended by the WHO in 2011 and a level of $\geq 6.5\%$ (≥ 48 mmol/mol) was taken as a cut-off for diagnosing type 2 diabetes in non-pregnant adults^[26]. Using HbA1c for diagnosis requires the International Federation of Clinical Chemistry standardised assays for its measurement to ensure the results produced using different assays are equivalent and reliable^[27]. In Nigeria, glycated haemoglobin levels are more often than not determined by point-of-care tests which are not stan-

dardized for use in diagnosing diabetes.

Management of persons with DM is composed of non-pharmacological and pharmacological components. We routinely offer both components of care to persons with DM even though most centres tend to underemphasize the non-pharmacological aspect paying attention mainly to the dietary aspect.

A component of comprehensive DM care as recommended by the American Diabetes Association includes a yearly laboratory evaluation for lipid profile, liver function test, serum creatinine and calculated glomerular filtration rate, test for spot albumin excretion and thyroid stimulating hormone in persons with T1DM, dyslipidaemia and women over 50 years of age^[24].

Dietary management is a key cornerstone modality in the attainment of good glycaemic control in DM. Dietary management of DM is targeted at improving the overall health by achieving and maintaining optimal nutritional status, attaining good glycaemic control and prevention of acute and long term complications of DM. There is no standardized diet for people with DM and the dietary requirements for people living with DM often are influenced by, socio economic status, religious beliefs and cultural beliefs. The current general recommendation is that carbohydrates should provide between 45%-65% of the daily caloric intake, fat should be 25%-35% of total daily calories and protein 15%-20% should be of total daily calories^[28]. In Nigeria there is the erroneous beliefs amongst many people that DM results from eating carbohydrates hence the popular view that people with DM should either completely avoid carbohydrates or at best take minimal quantities. The resultant sequelae of these wrong notions include the intake of monotonous meals which are deemed "safe" for people with DM. One of such meals that are commonly prescribed by well-meaning non healthcare professionals and uninformed medical personnel include unripe plantain and beans. In a report by Abioye-Kuteyi *et al*^[29] on dietary knowledge and practices in persons with T2DM, about half of the Study subjects ate a monotonous diet of mainly plantain and did not necessarily attain good glycaemic control.

These erroneous beliefs concerning dietary requirements in DM also affect the stance of patients when faced with the occurrence of iatrogenic hypoglycaemia. Some patients with DM have been noted to absolutely refuse simple sugars in the management of this life threatening acute complication of DM. There are varying Nigerian reports^[29,30] that note that adherence to dietary advice is often poor amongst people with DM. Dietary management as an aspect of DM care is seen as the turf of the nutritionists and as a result, quite a number of physicians have a poor know how on dietary counselling. Exercise is known not only to impart glycaemic control positively but also to reduce the risk of developing cardiovascular disease in DM.

DM is a diverse group of metabolic disorders that is often associated with a high disease burden in developing countries such as Nigeria. In the early nineties, not much

Table 1 Drugs that are currently employed in the management of diabetes mellitus in Nigeria

Oral glucose lowering agents
Biguanides
Sulphonylureas
Alpha-Glucosidase inhibitors
DPP-4 inhibitors
Parenteral glucose lowering agents
Human insulin
NPH insulin
Insulatard
Premixed (30/70)
Insulin analogues
Insulin glargine
Insulin lispro
Premixed: Novomix, Humalog (25/75)

DPP-4: Dipeptidyl peptidase 4.

was known about DM in Nigeria and traditionally, people related DM to “curses” or “hexes” and diagnosis was made based on blood tests or urinary tests for glucose. Currently, oral hypoglycaemic agents but not insulin are readily accessible and acceptable to persons with DM. The cost of diabetes care is borne in most instances by individuals and often payment is “out of pocket”—this being a sequel of a poorly functional national health insurance scheme. An insulin requiring individual on a minimum wage would spend 29% of his monthly income on insulin. Complementary and alternative medicine are widely used by persons with DM and forms an integral component of DM care.

Towards reducing the burden of DM in Nigeria, we suggest that there be concerted efforts by healthcare professionals and stakeholders in the health industry to put in place preventative measures, a better functioning health insurance scheme and a structured DM program.

The American Diabetes Association recommends that individuals with T2DM perform at least 150 min of moderate-intensity aerobic exercise and/or at least 90 min of vigorous aero-bic exercise per week^[27]. The erroneous impression amongst lay people that exercise should be performed with an intention to lose weight is all too pervasive in our practice. Exercise prescription is hardly done and when offered some physicians offer generic advice on exercise. In the Diabcare Study in Nigeria, only a third of persons with DM admitted to exercise adherence^[31].

The importance of self-glucose monitoring is known to the majority of persons living with DM even though this knowledge does not necessarily translate into implementation. The practice of self-glucose monitoring in DM ranges from 3.4% amongst patients with DM in rural settings to 73% in urban settings^[32-34]. Despite the limitation of urine testing, some patients still employ this technique for self-monitoring of glycaemic control. A Nigerian Report have noted that some patients with DM monitored glycaemia using urine tests with the aid of Clinitest tablets, urine dipsticks and in some rare instances, tasting the urine for sweetness^[33]. In some centres in

the more industrialized parts of the Nigeria the practice of urine testing for glucose is obsolete^[34,35]. Beyond, financial constraints, psychosocial factors have been noted to largely influence glucose monitoring in our setting^[35].

Pharmacological treatment of DM is composed of both insulin and oral glucose lowering drugs and in some instances complementary and alternative medicine. Effective usage of insulin in the management of glycaemia remains a challenge in developing countries like Nigeria and about a fifth of persons with T2DM are on insulin therapy solely or in combination with oral glucose agents^[36].

Currently available human insulins are the short acting or meal time insulins, premixed insulin and the long acting insulins. The insulin analogues were introduced into the Nigerian market about three years ago and are still not readily accessible in terms of availability and affordability. Premixed analogues are the types of insulin analogues that are predominant and only one long acting analogue (glargine) is available in the country till date. Insulin administration devices such as the syringes and pre-filled pens are readily available but insulin syringes are the dominant forms of devices in use. Unfortunately there is no uniformity or standardization of insulin syringes in use and this is because of parallel importation of drugs and an absence of gazetted policies on DM management. The barriers to insulin usage include patient factors such as needle phobias, fear of hypoglycaemia, weight gain and costs. Healthcare provider factors include inertia on commencing insulin and this may be presumably a result of ignorance on when to start insulin and sometimes misguided attempts to “empathise” with the patients. In a report by Ogbera *et al.*^[36], well over half of persons on insulin paid for their insulin themselves and the mean costs of procuring insulin per month was determined to be about 37 dollars per month. The Report also noted that persons on minimum wage spent 29% of their monthly salaries in the procurement of insulin.

Oral hypoglycaemic agents (OHAs) are readily available and commonly used OHAs are metformin, glimepiride and glibenclamide. Other available therapies, *viz.*, thiazolidinediones, alpha glucosidase inhibitors and the dipeptidyl peptidase 4 inhibitors are prescribed mainly by endocrinologists. Although OHAs are clearly not indicated for use in persons with T1DM, there are few cases of persons with clinical features of T1DM being placed on OHAs by general practitioners. A summary of glucose lowering agents used in the management of DM in Nigeria is shown in Table 1.

Complementary and alternative medicine (CAM) usage is an important facet of management of DM and a Nigerian Report noted that 46% of persons with DM used CAM with biological based therapies being the prevalent forms of CAM utilized^[37].

A commonly used CAM therapy for the DM and hypertension is *vernonia amygdalina* which in local parlance is known as “bitter leaf”, the widely held belief is that the bitter taste of this therapy counteracts the “sweetness” in the blood. This view although appears simplistic, may

have some scientific basis as Nigerian researchers have reported a lowering of blood glucose in diabetic rats and this lowering of glucose was comparable to that recorded in diabetic rats who had oral glucose lowering agents administered to them^[38,39].

The burden of DM is attributable to complications which may be acute or chronic. Hyperglycaemic emergencies remain a major cause of concern in Nigerians with DM, accounting for 40% of all DM admissions with documented determinants of fatal outcomes being DM foot ulcers, hypokalaemia and sepsis^[40,41]. Of all DM admissions hyperglycaemic emergencies are listed as one of three complications of DM associated with high case fatality rates^[42]. Foot ulceration is one complication of DM that is widely reported on with a prevalence rate of about 9.5%^[43]. Foot ulceration is reported to occur in 25%^[44] of all new cases of DM and associated with an in-hospital mortality rate of 43%^[45]. A major risk factor for DM foot ulceration is neuropathy (and this is eminently preventable). However in terms of treating the diabetic foot, not much progress has been made but preventative strategies with a focus on patient education have greatly improved.

Diabetic nephropathy is assuming an increasing role as a cause of chronic kidney disease in Nigeria and it is one of the leading cause of chronic kidney disease in patients starting renal replacement therapy. DM nephropathy is associated with increased cardiovascular risk. Cardiovascular complications of DM such as Stroke, and peripheral disease have been reported in 11%^[46] and 37%^[47] of persons with DM respectively in hospital settings in Nigeria. DM has also been noted to account for 2.1% of cases of heart failure^[48]. Conventional cardiovascular risk factors such as hypertension, metabolic syndrome and dyslipidaemia are now routinely screened for in persons with DM and the use of statins and antiplatelet drugs are on the increase more than ever before in DM clinics. Novel cardiovascular risk factors such as elevated C reactive protein, and lipoprotein are not screened for routinely and remain issues of research concerns.

Diabetic retinopathy is a leading cause of blindness in people with DM and accounts for 16.2% to 42.1%^[49,50] of retinal diseases. Unfortunately investigative techniques such as fluorescein angiography, and interventions such as laser treatment are not readily available for the detection and management of some of these eye complications of DM.

Erectile dysfunction is a prominent clinical feature of hypogonadism and usually associated with low testosterone levels. A third of all males with DM present with the testicular deficiency syndrome but less than half of these patients discuss this problem with their care givers^[51]. A lot of unlicensed therapies are in the Nigeria market for treating erectile dysfunction but medical therapies available include the PDE 5 inhibitors, testosterone injections and the vacuum device which was introduced this year-2014-but is yet to gain wide acceptance. Sexual dysfunction in women with DM is an understudied aspect of

DM complications and often there are no interventions offered in our locale. Whilst the occurrence of sexual dysfunction in women with DM is comparable to that of women without DM, psychological morbidity appears to be a contributory factor in women with DM^[52].

Managing diabetes involves stakeholders of which national bodies on DM play a vital role. There are two umbrella bodies that serve the interest of DM in Nigeria and these are Diabetes association of Nigeria and the Endocrine and metabolic society of Nigeria. The afore stated bodies are charged with articulating guidelines on DM and also collaborating with policy makers and non-governmental bodies in order to reduce the burden of DM. At present, there is a National Guideline document on DM and a Lagos State Guideline-sponsored by Structured Healthcare Initiatives, an non governmental organization run by the primary author. The importance of having a clinical practice guideline document on DM cannot be overemphasized. A guideline document creates opportunity for assessment and standardisation of care, raising awareness on DM and empowering healthcare professionals at all levels of healthcare delivery at all locations (rural as well as urban areas) to detect and manage DM.

THE FUTURE

The keys issues with regards to diabetes in the future relate to the increasing population of Nigerians, increasing life expectancy of Nigerians, projected increase in the incidence and prevalence of diabetes, low per capita income of most Nigerians, poorly developed health care infrastructure and the current situation where the predominant means of procuring health services is "out of pocket" payment.

The aforementioned factors will result in increased numbers of persons with the complications of diabetes particularly against the backdrop of constrained health budget by various tiers of governments. Indeed the budgetary allocation to health for the 2014 fiscal year by the federal government of Nigeria at 6% remains less than 15% recommended by the WHO^[53]. This is ironic as Nigeria was one of the African countries which participated in the 2001 Abuja^[53]. There is need for government to increase the budgetary allocation for health as recommended by the WHO.

The prevention and improved management of diabetes will require cooperation between the government and the health sector. There is need for preventive programs such as enlightenment campaigns on the risk factors of diabetes. Government at all levels will need to improve health care funding.

The Health insurance scheme in Nigeria is poorly developed and currently, the majority of health insurance facilities do not provide coverage that allows for provision of optimum standard of care for persons living with DM. Out of pocket expenditure remains the major means of funding health care for the vast majority of Ni-

gerians now and in the foreseeable future.

The use of HbA1c for the diagnosis of diabetes remains limited by high cost. In one medical facility^[54], it cost the equivalent of 19 USD to perform an HbA1c test. The relatively high prevalence of the sickle cell gene in Nigeria may impact on the assay for HbA1c.

Although several new agents have emerged for the treatment of diabetes such as insulin analogues, glucagon like peptide 1 analogues, amylinomimetics, inhaled insulin and insulin pumps, the country is probably better served by the regular availability of a few cheap diabetes medications with well-established safety profiles such as metformin, glibenclamide and gliclazide. Although lactic acidosis is a stated complication of metformin, the reality is that it is exceedingly rare even in patients with significant renal impairment and it has shown proven safety profile over decades of use.

There is the need for collaboration between health-care providers, the pharmaceutical industries, policy makers and National agency for food and drug administration and control to ensure adequate regulation of the importation, local manufacture and use of anti-diabetic medications in Nigeria. Whilst the provision of continuous blood glucose monitoring systems are expensive for our economy, the use of standardized glucometers and test strips particularly for persons on multiple insulin injections needs to be encouraged. Some other areas of unmet needs include the availability of DM educators and podiatry specialists.

CONCLUSION

The status of provision of DM care has greatly improved in Nigeria but areas of concerns remain and some of these include financing and suboptimal patient education. Concerted effort should be put in place by healthcare professionals and all stakeholders in ensuring that optimal care for persons with DM is attainable in Nigeria.

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