Editorial

Diabetes in Africa - Puzzles and challenges

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Diabetes in the African continent provides challenges both to the researcher and clinician. From a research viewpoint, unusual subgroups of diabetes are encountered in Africa; and the epidemiology of both type 1 and type 2 diabetes differs from many western countries. Clinically, the challenge is to provide care for rapidly expanding numbers of diabetic patients, with severely limited resources.

The "Timebomb" of Type 2 Diabetes

As elsewhere in the world, type 2 diabetes is the predominant sub-group encountered. Overall, Africa is currently not a high prevalence area for type 2 diabetes (such as, for example, the Middle East or the Caribbean). Most African countries have estimated prevalence rate of 2-3%, though it should be emphasized that these figures are now over a decade old - from a 2003 survey by the international diabetes federation. They were also derived from extrapolations from the results of smaller localized studies.[1] In addition to these background rates, there are particular ethnic groups in Africa known to have a particularly high risk of type 2 diabetes. These include the Cape-colored population in and around Cape Town, South Africa; as well as the descendants of Asian immigrants now living in or around Durban, South Africa and Mombasa, Kenya. In all these groups, type 2 diabetes prevalence is at least 10.0%.[1,2]

However, the real problem of type 2 diabetes in Africa is that the numbers are rapidly increasing at an unprecedented rate. Compared to numbers in 2000, it is estimated that in sub-Saharan Africa, there will be a 161% increase by the year 2030, compared with a world average increase of 114%.[3] As sub-Saharan Africa contains some of the world's poorest countries, this huge increase will therefore occur in a region, which is economically least able to cope with the burden.

What is Driving the Type 2 Epidemic?

There seems little doubt that the major driving force for the escalating numbers with type 2 diabetes in Africa is "epidemiological transition" in its broadest terms. This includes high rates of rural-urban migration, reduced food quality and increased food quantity, reduced exercise and increased life expectancy. All of these are potent risk factors for type 2 diabetes. Over half of Africa's population now live in towns or cities, and this will probably rise to about two-thirds within the next decade. African cities are visibly enlarging; taxis and buses reduce the need for exercise, and fast-food outlets are overtaking the traditional African diet.[4,5]

There remains debate as to whether Africans may have increased susceptibility to the diabetogenic effects of westernization. These could include genetic factors - Neele's "thrifty genotype" remains an attractive hypothesis;[6] or environmental fetal factors – the "fetal origins" hypothesis relating *in utero* malnutrition to increased later type 2 risk (the "thrifty phenotype").[7] Both of these mechanisms will lead to sub-clinically reduced insulin secretion, destined to lead to likely diabetes if weight gain and/or reduced exercise occurs (i.e. after an urbanization).

An additional growing problem in Africa is the now widespread use of anti-retroviral (ARV) drugs for HIV/AIDS. A number of these are known to lead to central obesity and glucose intolerance, factors which are likely to further increase the future burden of type 2 diabetes in the African continent. As well as their specific diabetogenic effect, widespread ARV use will raise life expectancy and this in itself will increase type 2 diabetes risks.

Access this article online	
Quick Response Code:	Website: www.ijem.in
	DOI: 10.4103/2230-8210.131111

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The Puzzle of African Type 1 Diabetes

At least in sub-Saharan (rather than north) Africa, type 1 diabetes appears significantly less common than in Europe and North America. This appears to be confirmed by a Tanzanian study in the early 1990s, estimating type 1 incidence at 1.5/100,000/year (rates in Europe are around 15-20/100,000/year.[8] It has been widely suggested that this apparently low incidence may be due to high mortality in ketoacidosis (diabetic ketoacidosis) occurring before presentation to hospital, but most diabetes specialists in Africa have not been totally convinced by this. A fascinating but little quoted study from Johannesburg, South Africa, in 1993 may help to explain this epidemiological puzzle. In this area, there are both white and black indigenous African populations, and the researchers compared the age of onset in white and black type 1 diabetic patients. There was an approximate 10 year gap in onset, with the mean age of onset being 23 years in blacks and 13 years in whites.[9] This may at least partly explain overall low incidence in blacks, and why the disease is rarely encountered by pediatricians in sub-Saharan Africa.

Other potential factors favoring low type 1 incidence may be prolonged breast feeding (known to be protective against later type 1 diabetes development),[10] and the "Hygiene hypothesis." The latter is more commonly implicated in asthma epidemiology, but there is evidence that recurrent childhood infections may lead to immune modulation, favoring a reduced later risk of islet cell auto-immune attack, and the onset of type 1 diabetes.[11]

Interestingly, in North Africa, where ethnic origins are slightly different from sub-Saharan Africa, type 1 diabetes appears to be similar to the disease seen in western countries. It is not infrequently seen in childhood, and a study from Sudan showed incidence of 10.0/100,000/year.[12]

Before leaving the issue of type 1 diabetes in Africa, it should be noted that most of the references in this section are rather dated, and it is regrettable that more active up-to-date research on type 1 diabetes epidemiology in Africa is not taking place.

Classification Issues in Africa

Two specific and distinct sub-groups of diabetes are seen in Africa – malnutrition related diabetes mellitus (MRDM), and atypical ketosis-prone type 2 diabetes. MRDM occurs in many parts of the tropics, and has been particularly well-described and research in India.[13] It is of unknown cause, but past or present malnutrition is always present. It occurs in young adults, and is more common in men. Other descriptive names for MRDM are "tropical diabetes" or "tropical pancreatic diabetes," the latter term referring to the frequent association with exocrine pancreatic damage – for example, pancreatic calcification and/or fibrosis and steatorrhea.[14] MRDM was first described by Zuidema in Indonesia in 1959 (so-called "Z-type diabetes"),[15] though Hugh-Jones' report of 1955 in Jamaica ("J-type diabetes") may have represented MRDM.[16] Over the years MRDM has had a controversial history, being variably accepted as a true sub-group of the diabetic syndrome. However, recent work for Ethiopia has strongly supported the existence of MRDM in a famine area in the north of the country.[17,18] Though an association with malnutrition appears established, the true cause of MRDM remains unknown. As Tom Johnson (a well-known Kenyan diabetologist) observed over 20 years ago, MRDM is "a syndrome seeking clarity."[19]

Atypical type 2 diabetes (or atypical ketosis-prone type 2 diabetes) is a form of diabetes characterized by the young age of onset with severe hyperglycemia and/or ketosis, followed by remission. Typically, these patients are initially treated with insulin, but later become controllable with oral agents or diet alone.[20] The same syndrome had probably been described much earlier, with labels such as "phasic insulin-dependence."[21] As well as occurring in various parts of Africa, atypical type 2 diabetes has been described in African-Americans, where it is sometimes known as "Flatbush diabetes."[22] An interesting clue as to the possible etiology of atypical ketosis-prone type 2 diabetes has been provided recently by Sobngwi *et al.* in Cameroon.[23] Antibodies to human herpes virus 8 were found in 88% of patients with atypical diabetes, and only 15% of a control group with standard type 2 diabetes ($P < 0.001$). A viral "insulitis" might explain the abrupt onset, but later remission of this fascinating category of diabetes.

Conclusions

This article has reviewed issues of diabetes epidemiology and classification in Africa. Though topics such as MRDM, atypical type 2 diabetes, type 1 incidence, thrifty genes etc., are all fascinating; the real problem Africa faces is the epidemic of type 2 diabetes, largely driven by urbanization and westernization. Coping with this is a major challenge to Africa's health services. Economic shortages also mean that effective diabetes care can be difficult – in many areas specialist teams, laboratory support, and even provision of insulin is inadequate.[24]

However, reports are emerging from various parts of Africa, showing that practical and appropriate methods of diabetes care

delivery can be highly successful. Initiatives from Ethiopia,[25] Ghana[26] and rural South Africa[27] have used techniques including patients and staff education, nurse-led systems of care, clinical algorithms and devolution of care to the primary health center level. Though the challenges of care delivery remain considerable, the efficient use of available resources can provide effective care for Africa's diabetic population.

Much of what has been discussed in this article is of relevance outside Africa, including in India and the south-Asian sub-continent. MRDM is well-described in India, and has been studied scientifically by many workers in that country.[13] India is also experiencing a major increase in the prevalence of type 2 diabetes, largely driven as in Africa by urbanization, weight gain and sedentary lifestyles. Delivery of care to India's huge diabetic population is also challenging, and will increasingly need some of the methods which are being explored in Africa – for example by use of nurse-led systems[26,27] and clinical algorithms.[27] Finally, it is encouraging that systems of diabetes care developed specifically for the tropics, are now being transposed to western countries, where there is increasing pressure on traditional "doctor-led" patterns of care. Thus, the nurse-led systems of out-patient care in rural South Africa[27] have been adapted for successful risk factor management in type 2 diabetes patients in the UK.[28]

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Cite this article as: Gill G. Diabetes in Africa - Puzzles and challenges. Indian J Endocr Metab 2014;18:249-51.

Source of Support: Nil, **Conflict of Interest:** None declared