Diabetes Mellitus in Black South Africans

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INTRODUCTION

Black South Africans comprise 80% of the total population of the country. Traditionally, rural dwellers, were unaccustomed to the stress of urban life, their diet was high in fiber and carbohydrate and low in fat. Over the past three decades, there has been accelerated urbanization and it is projected that 80% of this population will be urbanized by the year 2000. Thus, in the lifetime of one generation, a population of rural dwellers will have migrated to the city. Studies conducted worldwide have revealed that acculturation, urbanization or adoption of a western lifestyle have resulted in a marked increase in the prevalence of diabetes. It is against this background that diabetes [1] in the African population should be seen.

Non-insulin-Dependent Diabetes Mellitus

Epidemiology The first studies investigating the prevalence of diabetes in Africans in this country were, with one exception (in Tonga at), based on hospital outpatient populations and all depended upon the presence of glycosuria. In these, the prevalence was low varying from 0.02 to 1.3% [2, 4]. Subsequently in the 1960's, Jackson and colleagues conducted the first population-based studies in Guguletu and Mamelodi, African residential areas near Cape Town and Pretoria respectively [5]. In these studies, oral glucose tolerance tests using 50 g glucose were used and prevalence's of 3.6% in Cape Town and 2.9% in Pretoria, were found. This is not dissimilar from that reported in Whites by the same group of researchers. There was a dearth of further epidemiological investigation into diabetes in Africans until recently, when studies were conducted to investigate the prevalence and risk factors for NIDDM in Africans in the urban setting utilizing the 1985 WHO criteria. As indicated in Table 1, a similar prevalence of NIDDM was

Table 1
Age Standardised Prevalence of NIDDM in Africans in Studies using the 1985 WHO Criteria

Area	Study Population (Yrs)	Prevalence		IGT
		Sample Size	Diabetes (%)	
Cape Town	≥ 30	729	8.0	7.0
Durban	≥ 15	479	5.3	7.7
QwaQwa* (8, 9)	≥ 25	853	4.8	10.7
Mangaung (8, 9)	≥ 25	741	6.0	12.2

* semi - urban

reported in the three urban African communities [6, 8]. In QwaQwa, a semi-rural area close to Bloemfontein, the age-standardised prevalence of diabetes was similar to that in the City of Bloemfontein [9]. A point of difference in the studies was the higher prevalence of IGT relative to diabetes in Manguang and QwaQwa compared to Durban and Cape Town. This may indicate that the prevalence of diabetes is likely to rise in the former two areas.

The risk factors for NIDDM were also investigated in two of these studies. A sex difference in the prevalence was noted in the Durban study, with diabetes twice as common in women than in men, while the reverse was true of IGT. The reason for these differences is unclear. Obesity, defined as BMI > 25 Kg/m^2 in women and > 27 Kg/m^2 in men, was identified as a significant risk factor in both, the Cape Town and Durban studies [6, 7].

Further risk factors for NIDDM, namely family history, age, upper segment fat distribution, physical activity, alcohol intake and urbanization were sought in the Cape Town study in which, the crude prevalence of NIDDM increased with both increasing BMI and upper segment fat distribution [6]. In non-obese subjects with lower segment fat distribution, the crude prevalence of NIDDM was 1.3% compared to 4.8% in the obese. In those with upper segment fat distribution, the non-obese had a crude prevalence of 10.9% while in the obese the prevalence was 16%. The additive effect of obesity and upper segment fat distribution was consistent in men and women.

In this country, with its history of migrant labor and the consequent movement of family members between the city and rural areas, there is a lack of a truly rural population. It is in the light of this that an attempt was made to evaluate the effect of urbanization on the prevalence of acculturation, changes in dietary and exercise patterns, as well as alteration in levels of stress which as such are difficult to quantify. In this study, urbanization was defined as ³ 40% of life spent in the city, in order to adjust for age. The prevalence of diabetes rose from 2.7% at 20 to 39% of life spent in the city to 7.4% at 40 to 59% of life spent in the city and progressively to 11.3% with > 80% of life spent in the city. Multivariate analysis indicated that age (odds ration 4.18, 95% CI 2.48 – 9.52), urbanization (odds ration 2.32, 95% CI 1.09 – 4.95), upper segment fat distribution (odds ratio 2.94, 95/5 CI 1.47 – 1.65) and obesity

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(odds ratio 2.31 95% CI 1.06 – 5.02), were all independent risk factors for NIDDM. Sex, alcohol intake, family history and physical activity were not associated with NIDDM.

The prevalence of NIDDM found in the urban African population in South Africa was considerably higher than that of 1.1% (age-adjusted) reported from rural Tanzania [10]. This probably relates to greater levels of obesity, urbanization and less physical activity in the local population.

The population-attributable risk factors for NIDDM calculated in the study in Africans in Cape Town, were 40% fro urbanization, 43% for obesity and 53% for upper segment fat distribution. Since these were independent factors, it is possible that if all three risk factors were removed, the prevalence of NIDDM would fall from a crude rate of 6.3% to an estimated 1%. This information gives a clear indication of the need for interventive programmes directed at reduction in obesity, upper segment fat distribution and to a lesser degree, lifestyle changes associated with urbanization.

Pathogenesis of NIDDM

Although two main theories for the pathogenesis of NIDDM have been proposed; internationally, debate still rages as to whether peripheral insulin resistance or insulin secretary dysfunction is the primary cause. It is not certain that African NIDDM may follow the same path as other groups. Joffe et al have suggested that in Africans the primary defect is that of diminished beta-cell function [11, 12]. This is based on studies which have demonstrated that African NIDD's have smaller insulin responses to beta-cell stimulation than Indian NIDD's and even non-diabetic Africans had a lesser insulin response to beta-cell stimulation than that observed in Whites [13, 14, 15]. There also appears to be a rapid fall off in residual beta-cell function in African patients with NIDDM compared to studies conducted in White NIDDM [11]. However, insulin resistance, determined both by, euglycaemic clamp techniques and insulin receptor concentration and binding, has also been found in African NIDDM, although diminish insulin secretion was present in both the studies [16, 17]. Joffe et al have proposed that the primary defect is a decrease in the function of the inadequate perinatal nutrition, further evolution of NIDDM being dependent upon the subsequent development of peripheral insulin resistance due to environmental factors including obesity, hypertension, decreased physical activity and urbanization. This is followed by a further decline in beta-cell function and ultimate exhaustion of the limited beta-cell reserve. The proposal is partly based on the Barker and Hales hypothesis that inadequate early nutrition with resultant low birth weight has as one of its numerous important consequences, an increased susceptibility to NIDDM, possibly on the basis of impaired development of the endocrine pancreas [18]. Studies in larger numbers of patients are awaited to validate the hypothesis of Joffe and associates.

Although candidate genes for NIDDM are being eagerly sought in other parts of the world, this has not been actively studied in the African population in this country.

Insulin-dependent diabetes mellitus

Epidemiology

There are no reported studies on the prevalence or incidence of IDDM in the African population of South Africa. Childhood Diabetes in Africa is rare and the annual incidence is 1.5/1,00,000 people (age group 0 – 19 years) in Tanzania, which is the only sub-Saharan country where this has been examined [19]. Despite the lack of data on incidence the female preponderance [22] and age of onset of African IDDM has been reported [20, 21]. Only in 7% of 176 patients with IDDM, the disease presented itself before 12 years of age. There was a small broad peak from 14 – 17 years but unequivocally, the peak age of onset was 22-23 years; a full decade later than in those in this country of European extraction [20].

Pathogenesis

The observation of a similar proportion of islet cell antibodies in African and India IDDM patients supports the contention that immunological mechanisms also play a part in the pathogenesis of IDDM in this group [22]. An association of HLA B8 with IDDM in Africans was reported [23] but not confirmed in subsequent studies in which a significant association between IDDM and DR4 was found [24]. Further studies are awaited to fully elucidate the HLA susceptibility loci for the development of IDDM in Africans.

Other types of Diabetes Mellitus

Malnutrition-related diabetes [21, 25] and diabetes secondary to iron overload are rarely found in this country [12].

Complications of diabetes mellitus

Acute metabolic complications

In tropical Africa, hypoglycemia is a significant cause of death in diabetic patients [26]. No comparable figures are available from South Africa, however, severe hypoglycemia is a frequent and important acute diabetic complication in African diabetics. This accounted for 6% of admissions of diabetics to Baragwanath Hospital, in Soweto, the African residential area outside Johannesburg, with a population of approximately 4 million [27]. In this study, there was no mortality or obvious long-term morbidity while identification of the precipitating factors highlighted the need for improved patient education in the prevention of this complication. Hyperglycemic emergencies continue to be an important problem in African diabetics. In 1981, during an eight-week period, 60 patients were admitted to Baragwanath Hospital requiring intravenous insulin and fluids, of which 25% died in hospital. Another 3 patients died within 3 months after discharge and one-third of those discharged were readmitted within 3 months [28]. The identification of precipitating factors such as poor compliance, lack of response to significant symptoms, lack of patient knowledge and skill, failure to issue diabetic identification bracelets, led to a programme of improved diabetic management resulting in a decline in the mortality rate from 25% to 10%, as well as in the number of admissions, indicating that considerable improvements can be brought about by effective patient and health worker education [29].

Chronic complications

The frequency of chronic complications of diabetes in Africans has not received a great deal of attention. The studies that have been conducted have used different methodologies and patient populations resulting in a wide variation in the reported prevalence of these complications [30, 31]. (Table 2)

Table 2
The Prevalence of Chronic Complications In African Diabetics

Hospital	King Edward VII(30)	Baragwanath(31)
Type of Diabetes	IDDM	IDDM/NIDDM
No.	92	475
Method	Clinical Examination	Record review
Cataracts	5%	10%
Retinopathy	14%	3%
Nephropathy	3%	1%
Hypertension	4%	35%
Peripheral neuropathy	22%	6%
Autonomic neuropathy	4%	--
Ischaemic heart disease	--	0.4%
Peripheral Vascular disease	--	2%

The prevalence of macro vascular complications in African diabetics has also received little attention. Although the rarity of ischaemic heart disease in both diabetic and non-diabetic Africans has long been recognized [32], strokes are a more common problem [33].

Conclusion

The major question as to whether the prevalence of diabetes is increasing with time still remains unanswered. This is due to the difficulty in comparing early epidemiological studies with the most recent ones, in view of the different methodologies and diagnostic criteria used. Nonetheless, the relationship between urbanization and the prevalence of diabetes should ring alarm bells and promote the introduction of primary interventive programmes in order to prevent this disease with its considerable morbidity and mortality. This, together with a better understanding of the pathogenesis of the disease and provision of improved health services for the management of diabetes in the community are the challenges of the future in this society.

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