

The Clinical Pattern of Diabetes Mellitus in Ethiopians

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Records of 849 consecutive diabetic Ethiopians revealed that 171 had type I diabetes, 462 type II nonobese, 210 type II obese, and 4 drug-induced. Undernutrition (BMI < 18 kg/m²) was present in 12.9% of patients. Forty percent of all patients require insulin; ketoacidosis has occurred in 7.8%. Diabetes was present 10 yr or less in 73%, only 11% have been diabetic more than 15 yr, and none more than 32 yr. During 7 yr, 66 (7.8%) are known to have died. Renal failure caused 30.3% of known deaths, and ketoacidosis 3%. About 4% of those diabetic 6–10 yr have a clinically significant complication. The incidence of “diabetic triopathy” rose rapidly after 10 yr. Of those diabetic 16–20 yr, 27.7% had nephropathy, 27.7% neuropathy, and 33.3% retinopathy. Hypertension was seen in 12.1% of patients without nephropathy. Cataracts were seen in 1.4% of new diabetic patients, rising to 40.7% in those diabetic more than 20 yr. Peripheral vascular disease was uncommon and myocardial infarctions occurred in eight patients. Thus, “diabetic triopathy,” hypertension, and cataracts are frequent in and after the second decade of diabetes in Ethiopians. *DIABETES CARE* 7: 6–11, JANUARY–FEBRUARY 1984.

In 1980 the World Health Organization¹ estimated that diabetes mellitus affects 30 million persons throughout the world, commenting that information about incidence, clinical features, and long-term sequelae is inadequate in many of the so-called “developing nations” for rational health care planning for the diabetic population.

The present study was undertaken to define the clinical features of diabetes mellitus, as seen in Addis Ababa, Ethiopia.

CLINICAL MATERIAL

Clinical records, including notes of each follow-up visit, have been carefully kept on all diabetic Ethiopians attending a twice-weekly Diabetic Clinic at Yekatit 12 Hospital, a 300-bed general hospital in Addis Ababa. The period from April 1976 to July 1983 has been reviewed. All patients were seen by the same physician.

Most patients are referred from the outpatient departments and wards of the same hospital, a few are referred by physicians in other institutions, and some are brought by diabetic relatives and friends. Because of scarcity of medications and poor laboratory facilities in many rural hospitals, some patients travel as far as 300 km to obtain medication, especially insulin. At least 17% of all patients come from rural areas

outside Addis Ababa, of whom a disproportionate number are insulin dependent.

Complete history and physical examination were done at the first visit, as well as blood glucose, blood urea nitrogen, complete urinalysis for glucose, albumin, acetone, and cells, and often chest radiograph. Blood glucose, weight, and blood pressure are checked at every visit, and other investigations done as clinically indicated.

For the first 4 yr glucose was measured in venous whole blood manually by a modified Folin-Wu technique, and since then by the glucose-oxidase technique on venous capillary blood using Dextrostix (Ames, United Kingdom) and an Ames Eytone reflectance meter. Urine glucose is checked with Clinitest (Ames) in the laboratory and Clinistix (Ames) in the clinic; albumin is usually measured by precipitation with 20% sulphosalicylic acid solution. Blood urea nitrogen is measured by a diacetyl monoxime condensation method and serum creatinine by a picric acid technique. Creatinine clearance cannot be done in this hospital.

Diabetes mellitus was diagnosed if fasting blood glucose was greater than 140 mg/dl, random blood glucose greater than 200 mg/dl, or if the patient had a well-documented past history of treated diabetes. Ninety percent of all patients have had a fasting blood glucose greater than 200 mg/dl at least once over the years of follow-up. Diabetes was classified

according to WHO recommendations,¹ obesity being diagnosed if men had a body mass index (BMI) of greater than 27 kg/m² and women greater than 25 kg/m², using the weight before onset of diabetes if known and if significant weight loss had occurred.

Diabetic nephropathy was diagnosed when there was persistent heavy albuminuria in the absence of other known renal disease, which was excluded by history, urine culture, and intravenous pyelography. Renal biopsy is not possible in this hospital. Neuropathy was diagnosed if sensation was absent in the feet or if the patient had mononeuropathies or autonomic neuropathy. (Isolated depression of reflexes was not counted.) Fundi were examined for retinopathy with dilated pupils when dilating medication was available and, when possible, the patient was referred for an ophthalmologist's opinion. Blood pressure was considered elevated if it was persistently greater than 160/95 mm Hg.

In those who died, cause was determined on clinical grounds, autopsy rarely being obtained for religious and cultural reasons.

Insulin-requiring patients were seen every 2–3 mo if stable and more frequently if poorly controlled. Those patients on oral agents were seen 2 or 3 times yearly if well controlled: 8.5% of patients came only once, 52% 2–9 times, 21% 10–19 times, 14.5% 20–39 times, and 3.5% more than 40 times to the clinic. Patients with few symptoms on tablets or diet alone are extremely likely to come only once or twice, and are therefore hard to follow over time. At least 10% of all patients have poverty certificates, granted only if family income is less than 25 American dollars monthly.

Ethiopia, located in the northeastern horn of Africa and with one of the lowest per capita incomes in the world, has about 30 million people (a mixture of Hamitic and Semitic peoples, with Nilotic tribes in the south), less than 700 physicians, and about 70 hospitals in the nation.³

Malnutrition and infectious diseases dominate the problems of the health services; there is as yet little organized care for those with chronic diseases. Life expectancy at birth is about 45 yr for men and 41 for women.³ There is no organized registration of births, deaths, and causes of death, no population-based statistics on the incidence of diabetes, and no diabetic association.

TABLE 1
Diabetes mellitus in Ethiopians: classification

Type of diabetes	Men	Women	Total	Percentage of total
Type I	97	74	171	20.1
Type II nonobese	288	174	462	54.4
Type II obese	39	171	210	24.7
Drug-induced	2	2	4	0.5
Gestational	—	2	2	0.1
Totals	426	423	849	

TABLE 2
Diabetes mellitus in Ethiopians: nutritional status

	BMI (kg/m ²)	Men	Women	Total	Percentage of total
Undernourished	<18	67	40	107	12.9
Normal		316	198	514	61.9
Obese	27–30 (M)	27			
	25–30 (F)		125	152	18.3
Very obese	>30	12	46	58	7.0
Totals		422	409	831*	

*Excluding the 18 patients less than 16 yr old.

RESULTS

During the 7½ yr of this study, 849 consecutive diabetic Ethiopians were seen. There were 426 women and 423 men. Most patients (728, 81%) presented with the typical symptoms of diabetes mellitus; thirst, polyuria, fatigue, and weight loss. Eighty-nine patients (10.5%) were asymptomatic at the time of diagnosis with blood or urine glucose having been checked during an unrelated illness or because of a diabetic relative. Five patients presented in ketoacidotic coma, 13 women were referred because of vulvar pruritus, 12 were first diagnosed during pregnancy, and 2 were referred from ophthalmologists.

Table 1 shows the types of diabetes seen, and Table 2 the nutritional status of patients. There were 171 type I diabetic patients, 20.1% of all patients. Sixty-three of these patients had had documented episodes of ketoacidosis, several were diagnosed in childhood within a few days of onset of symptoms and so have never been ketotic, several (thin and symptomatic) gave a history of "diabetic coma" treated in other hospitals and/or in the past, which is not well documented, and the rest were young, thin, diabetic patients who rapidly became symptomatic and unwell when they omitted insulin. Where clinical doubt existed, patients were classified as type II nonobese.

Only 24.7% of all patients were obese (Table 2). Obesity was not common in the men, but was seen in 40% of the women, especially middle-aged and older women. In Ethiopia, traditionally, postpartum women are kept in bed for 6 wk and fed the best and richest food the family and friends can afford: this is a blessing for the poor and undernourished majority, but often a disaster in terms of increasing obesity after every delivery for those better off economically.

A body mass index of <18 kg/m² was found in 12.9% of all patients (compatible with malnutrition); of those diagnosed before age 30 yr, 32.8% have BMI <18. A detailed search for patients fulfilling the criteria of Ahuja⁴ for "malnutrition diabetes" in 202 young patients has been made. These criteria are (1) blood glucose more than 200 mg/dl at any time; (2) onset before age 30; (3) BMI <18 kg/m²; (4) absence of ketosis; and (5) insulin requirement 60 U or 1.5 U/kg/24 h. Only four patients fit all criteria, and none was

a convincing case,⁵ appearing to fit more appropriately into the type I classification.

Abdominal radiographs have been done for 189 patients, mainly in the young, thin, and insulin-requiring. Pancreatic calcification has been found in only two cases, both middle-aged men with a history of alcohol intake. One consumed about 1 L tej, local honey wine (mead), alcohol content 12%; and the other consumed at least 2 L of talla, a local beer, alcohol content 4.5%, daily, for more than 15 yr. Only one patient with parotid enlargement was seen. Cassava is not eaten in Ethiopia.

Diabetes mellitus was induced in one patient by steroids, and in three by pentamidine therapy for leishmaniasis, a known cause of diabetes.^{6,7} Diabetes mellitus followed viral hepatitis in four patients.

Documented episodes of ketoacidosis have occurred in 63 patients (7.8% of all patients). A history of known diabetes mellitus in a close relative was given by 136 patients (16%). Twenty patients (2.4%) are married to another person with diabetes.

Age of onset of diabetes mellitus is given in Table 3. Most patients (56.8%) were diagnosed between the ages of 30 and 49 yr. Onset was before age 20 yr in 10.6%, and after 60 yr in only 4.4%. The youngest patient was diagnosed at age 2 yr. A history of ketosis was found in 68% of patients diagnosed before age 9, in 29% diagnosed at age 10–19, and in 14% diagnosed at age 20–29, but in only 2% of patients with onset beyond age 30 yr (Table 3).

Forty percent of all patients required insulin therapy at their last clinic visit. Control has commonly been poor because of irregular diet, irregular supplies of drugs, and interruptions of therapy by the patients.^{8,9}

Table 4 shows the occurrence of clinically significant long-term complications of diabetes mellitus. Most persons seen had been diabetic 10 yr or less, and only 27 patients diabetic longer than 20 yr were seen during the 7 yr reviewed. Only two patients had been diabetic more than 30 yr. As demonstrated in Table 4, nephropathy, neuropathy, and retinopathy were frequent in the second decade of diabetes, and

affected almost one-third of patients in the third decade, as did cataracts. Retinitis proliferans was seen in nine patients.

In contrast, no patient complained of intermittent claudication, and pedal pulses were easily palpable in most long-term diabetic patients. Eight patients have required amputations over 7 yr, four of a single digit, four of the leg(s). Five of the amputations were due to ischemic gangrene and three to infection. Hypertension, without clinical evidence of diabetic nephropathy, was found in 103 patients (12.1%), adding the cost of other long-term medications to the diabetic therapy. Eight of the 849 patients have had nine acute myocardial infarctions during 7 yr. Eleven patients have had "strokes."

Three hundred fifty-four patients have been hospitalized 598 times in 7 yr, the commonest reasons being for stabilization of control and initiation of insulin treatment. There were 67 admissions for ketoacidosis in 46 patients with 2 deaths, 13 for severe hypoglycemia, 57 for acute infections, including only five for injection abscesses, and 28 in relation to pregnancy. There have been 33 pregnancies, resulting in 20 live healthy babies. (During the same period, there were 16 admissions for ketoacidosis of patients not known to the clinic of whom 7 died.)

Thirty-three patients (3.9%), usually young, thin, and on insulin, have been treated for tuberculosis in 7 yr. Thirty-eight patients have had recurrent problems with urinary infections and 23 have chronic liver disease. Other endocrine diseases seen were nontoxic goiter in 11 women, 3 cases of thyrotoxicosis, one of hypothyroidism, and one of acromegaly. One patient had xanthelasma. There was one case of rhinocerebral mucormycosis who survived with amphotericin treatment.

Sixty-six patients (7.8%) are known to have died in 7 yr (Table 5). Another 37 patients (4.4%) came regularly for at least 10 visits and then disappeared: some of these may also have died in other hospitals or of acute complications in the countryside. The average duration of diabetes mellitus at death was 11.8 yr; 42% had been diabetic less than 10 yr. The average age at death was 52 yr. Renal failure due to

TABLE 3
Diabetes mellitus in Ethiopians: age at onset

Age at onset (yr)	Male	Female	Total	Percentage of total	Percentage of age group with history of ketosis
0–9	7	15	22	2.6	68%
10–19	33	35	68	8.0	29%
20–29	73	40	113	13.3	14%
30–39	130	113	243	28.6	2%
40–49	107	132	239	28.2	2%
50–59	61	62	123	14.5	2%
60+	12	25	37	4.4	2%
Unknown	0	4	4	0.5	
Total	423	426	849	100.1	

TABLE 4
Diabetes mellitus in Ethiopians: complications

Duration (yr)	Total number	Number known to have				Percentage known to have			
		Retino-pathy	Nephro-pathy	Neuro-pathy	Cataracts	Retino-pathy	Nephro-pathy	Neuro-pathy	Cataracts
<1	71	0	0	2	1	—	—	2.8	1.4
1-5	359	4	3	20	13	1.1	0.8	5.6	3.6
6-10	189	7	5	16	8	3.7	2.6	8.5	4.2
11-15	126	22	18	16	25	17.5	14.3	12.7	19.8
16-20	65	16	18	18	22	24.6	27.7	27.7	33.8
>20†	27	9	8	6	11	33.3	29.6	22.2	40.7
Unknown	10	1	0	2	1				
Total	847*	59	48	80	81	7.0	5.6	9.4	9.5

* Excluding two gestational diabetes cases.

† Only eight patients were diabetic more than 25 yr.

diabetic nephropathy was the commonest cause of death (22.7%) and a further 7.6% died of renal failure apparently due to other renal disease. Six of the 66 patients died of "strokes," one of complete heart block, 3 of myocardial infarcts, and 2 in congestive heart failure. There were two deaths due to ketoacidosis and two to hypoglycemia. Three deaths were related to gangrene and amputations, and four to tuberculosis. Twelve percent of deaths were due to chronic liver disease, reflecting the high incidence of liver cirrhosis and hepatocellular carcinoma in Ethiopians in general.¹⁰

DISCUSSION

Although childhood diabetes has previously been thought rare in African populations,¹¹ 59 (7%) of these 849 Ethiopians developed diabetes at or before the age of 15 yr, an incidence of childhood onset similar to that in Western series.¹²

In Great Britain, 45% of all cases of diabetes mellitus are diagnosed after the age of 60 yr.¹³ In contrast, only 4.4% of these Ethiopian diabetic patients were diagnosed after age 60, reflecting the life expectancy at birth for Ethiopians of 45 yr for men and 41 for women.³ As in Nigeria,¹⁴ Senegal,¹⁵ and North India,¹⁶ most were diagnosed in the fourth and fifth decades of life. As life expectancy improves in Ethiopia, particularly if accompanied by an increased incidence of obesity, diabetes may be expected to become more common.

Most of these patients were diagnosed when relatively young, there were few elderly patients, and most had symptoms when diagnosed. Only 10.8% were asymptomatic at the time of diagnosis, although it is said one asymptomatic case exists for every known one in many populations.² These points explain the high proportion of "type I" diabetes in this group of Ethiopian patients.

The fact that Ethiopians are diagnosed as diabetic mainly in young adulthood and middle age is reflected also in the large proportion of type II, NIDDM, patients who are not obese, since in other populations it is mainly those diagnosed

after age 45 who are significantly overweight.¹³ Similarly, in a series from North India with onset most commonly in the third to fifth decades of life, only 6% of those less than 40 yr old were obese.¹⁶

Obesity was common in middle-aged and older women, and much less common in the men. Malnutrition and undernutrition are common in Ethiopia; the Ethiopian Nutrition Institute has no data on the incidence of obesity in the general population, which appears, however, to be very low.

Body mass indices of <18 kg/m² were seen in 12.9% of these patients. Although few Ethiopians know their exact body weight and most nondiabetic Ethiopians are slender, with mean daily energy intake in one survey being estimated at 67% of the ideal,¹⁷ these patients generally give a definite history of weight loss associated with diabetic symptoms, and of a preceding "normal" size. It is common for Ethiopian

TABLE 5
Diabetes mellitus in Ethiopians: cause of death

	Number	Percentage
Chronic renal failure	20	30.3
Chronic liver disease and/or hepatoma	8	12.1
Diabetic ketoacidosis	2	3.0
Hypoglycemic reactions	2	3.0
Cerebrovascular accident	6	9.1
Cardiac disease	6	9.1
Cor pulmonale (old T.B.)	2	3.0
Pulmonary tuberculosis	2	3.0
Gangrene and/or sepsis	4	6.1
Carcinoma of the pancreas	1	1.5
Accident	2	3.0
Suicide	1	1.5
Cause unknown	10*	15.2
	66	

* Several of these were "sudden" deaths at home.

patients, especially the poor, the illiterate, and those from rural areas, to present to hospital, often a long journey from their home, only after months or even years of polyuria and polydipsia, giving adequate time for marked weight loss. It is therefore sometimes impossible to accurately assess pre-diabetic nutritional status. Many of the younger patients, although symptomatic for months or years, thin, and requiring insulin, do not often become ketoacidotic, even with interruptions of insulin therapy. It is interesting to speculate whether, if diet could be properly controlled and their nutritional status improved, treatment with oral agents might be possible in these patients, especially the 20–30-yr age group in whom ketosis is relatively uncommon.

It was once thought that the typical long-term complications of diabetes mellitus were not seen in African countries. However, more recent studies from Nigeria,¹⁴ Senegal,¹⁵ Kenya,¹⁸ and Tanzania¹⁹ indicate that diabetic persons on the African continent are as prone to these problems as anyone else. Table 4 demonstrates the rising incidence of nephropathy, neuropathy, and retinopathy with increasing duration of diabetes mellitus in 847 Ethiopians, nephropathy and neuropathy already affecting about one-fifth of patients in the second decade of diabetes. Although with improving medical services more patients are being diagnosed in recent years, the small proportion of patients diabetic more than 20 yr suggests that in Ethiopia at present the diabetic patient's chances for prolonged survival are limited. Similarly, the duration of life after diagnosis of diabetes in a Ugandan autopsy series was less than 5 yr in most patients,²⁰ and in Papua, New Guinea, the average life span after diagnosis is estimated at 4–5 yr.²¹ In marked contrast, more than 50% of Danish insulin-dependent diabetic patients survive more than 35 yr²² and life expectancy at the Joslin Clinic is more than 36 yr for type I diabetes.²³

In 41 Ethiopian patients with nephropathy, the mean duration of diabetes at onset of proteinuria was 11.8 yr, and mean survival until death in renal failure was 3 yr.²⁴ In contrast, combined data from several Western countries found the mean duration of diabetes at onset of proteinuria to be 17.3 yr and at end-stage renal disease, 21.3 yr.²⁵

Chronic renal failure was the commonest cause of known death (Table 5) and the 7% unknown overall mortality in only 7½ yr again indicates a poor long-term prognosis of diabetes in Ethiopia at present.

Control of hyperglycemia is commonly unsatisfactory in Ethiopian patients, the main reasons being cost of drugs, erratic supplies of drugs, inadequate understanding of the aims of dietary control and/or inability to alter diet because of poverty, and interruption of therapy for many social and economic reasons.^{8,9} Moreover, attempts at strict control in rural, insulin-dependent, often illiterate, diabetic patients who may only be able to travel to a hospital every 3 or 4 mo can result in disastrous hypoglycemia. Since diabetic microangiopathy is thought to be accelerated by prolonged hyperglycemia,²⁶ the relatively early onset of diabetic "triopathy" in these Ethiopian patients is not surprising. Enthusiastic attempts to make improved therapy of diabetes

mellitus available regularly and consistently to Ethiopian patients with diabetes mellitus are urgently needed if their life expectancy and quality of life are to be improved.

The data presented in this study are based on patients attending a diabetic clinic in an urban hospital, and are certain to be biased toward more ill and/or symptomatic patients, those requiring insulin, and those with easier geographic access to the hospital. More accurate data in epidemiologic terms could be obtained from population-based surveys identifying all diabetic patients. However, such surveys are not yet economically or logistically feasible in a nation such as Ethiopia where, still, most people die without ever having met a physician.³ They are also unethical until the health services can provide care, in terms of laboratory facilities, follow-up, and medications for all additional cases identified. Within existing facilities, even comparison of clinical data from rural and urban hospitals and clinics, identification of risk factors such as obesity in certain groups, and accurate documentation of complications and mortality in those already known can provide much useful information for health care planning for the nation's diabetic individuals.

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