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CLINICAL AND DEMOGRAPHIC CHARACTERISTICS OF GHANAIAN PATIENTS WITH DIABETES MELLITUS

F. K.TITTY, M. T. AGYEI-FREMPONG AND W.K.B.A.OWIREDU
(F.K.T.: Department of Medical Biochemistry, P.O. Box 1350, University for Development Studies, Tamale, Ghana; A-F. M. T. & W. K. B.A. O.: Department of Molecular Medicine, School of Medical Sciences, K NUST, Kumasi, Ghana)
* Corresponding author's e-mail: valtitfkt@yahoo.com

Abstract

The association of diabetes mellitus with demographic indices such as sex, age, obesity and hypertension varies between different ethnic groups and countries. The study investigated the association of demographic parameters with diabetes mellitus in Ghanaian diabetic patients. It was a study conducted on 456 diabetic patients at the Komfo Anokye Teaching Hospital Kumasi, Ghana, from January 2007 to May 2008. A standardised questionnaire was used to assess demographic characteristics. Blood pressure and anthropometric measurements (height and weight) were taken and body mass index (BMI) (kgm^{-2}) calculated . Fasting blood glucose concentrations were measured by enzymatic methods. There were more Ghanaian females with diabetes mellitus than males and more non-insulin requiring than insulin-requiring patients. The study also showed that 90.6 per cent of the Ghanaian diabetic patients were 40 years and above and had late onset diabetes, 60.5 per cent had diabetes duration of 1-9 years and carry clinical modifiable risk factors for microvascular disease, and 39.4 per cent of patients had clinical modifiable risk factors for cardiovascular disease with values in females higher than males.

Introduction

Diabetes mellitus is increasingly becoming an important cause of morbidity in developing countries (Bakari *et al.*, 1999). The prevalence of diabetes in the Greater Accra Region of Ghana has been found to be 6.3 per cent (Amoah *et al.*, 2002), a value higher than a world value of 2.8 per cent and 4.4 per cent estimated for 2000 and 2030 (Wild *et al.*, 2004). Globally, diabetes prevalence is higher in men, but there are more women with diabetes than men in Ghana. The prevalence of diabetes mellitus increases with age for both males and females (King *et al.*, 1998; Wild *et al.*, 2004).

In developing countries, the majority of people with diabetes are in the 45 – 65 years age group (King *et al.*, 1998; Wild *et al.*, 2004). The majority of type 2 diabetes patients are obese (Campbell & Carlson, 1993) or may have increased percentage of body fat distributed predominantly in the abdominal region (Kissebah *et al.*, 1982). Obesity is a powerful risk factor for hypertension. Hypertension is disproportionately higher in diabetics (Sowers & Haffner, 2002) and persons with elevated blood pressure are two and half times more likely to develop diabetes within 5 years (Sowers & Bakris, 2000). Obesity and hypertension are together associate with higher cardiovascular risk, the leading cause of death in type 2 diabetes (De Marco *et al.*, 1999).

Data on the clinical and demographic characteristics of diabetic patients representative of the Ghanaian population is scanty. The purpose of the study is to determine the association of clinical and demographic parameters of diabetes mellitus in Ghanaian diabetic patients and provide features of Ghanaian diabetics for reference and preventive strategies.

The study covered the period from January 2007 to May 2008 and was conducted at the Komfo Anokye Teaching Hospital, Kumasi in the Ashanti Region of Ghana. All study protocols were

approved by the ethics committee of the hospital. All participants provided their informed consent to participate in the research. Diabetes patients on insulin and or diet with oral hypoglycaemic drugs were selected.Diabetes was defined according to the WHO criteria. A standardised questionnaire was used to collect information on demographic characteristics such as age, sex, ethnic group, duration of diabetes, date of onset, medication history, family history of diabetes, hypertension, other physician-diagnosed diseases and stress.

Experimental

Four hundred and fifty-six (141 males and 315 female) diabetic patient were selected for the study. They included 250 (54.8%) Twi-speaking people, 30 (6.6%) Fantes, 38 (8.3%) Guans, 40 (8.8%) Ga-Adangbes, Northern extraction, 66 (14.5%) Ewes, 23 (5.0%) and 9 (2.0%) other Ghanaians who were not distinctly classified (Table1). The mean age of females (56.0 ± 12.4 years) was not significantly ($P = 0.62$) different from that of males (55.4 ± 12.2 years).

Height and weight of patients wearing lightweight clothing and without shoes and the body mass index (BMI) (kg/m^{-2}) calculated . Patients were classified as underweight (BMI < 18.5 kg m^{-2}), normal weight (BMI 18.5-24.9 kg m^{-2}), overweight (BMI 25.0-29.9 kg m^{-2}), or obese (≥30 kgm^{-2}) following the recommendations of the United States National Institutes of Health (1988). Patients who were taking antihypertensive medication were considered to have hypertension.

Blood pressure was measured twice from the forearm of each patient with 5 min intervals in the sitting position after 30 min of rest and the mean recorded. Blood specimens were obtained after 12 to 14 h overnight fast. Serum fasting glucose was measured by an enzymatic method using an ATAC 8,000 Random Access Chemistry autoanalyzer (élan diagnostics, A4-001-1198) and its reagent kits. Statistical analyses were performed using the statistical package for social sciences (SPSS) for windows programme version 11.0. Student's t test was used to determine the statistical significance of continuous variables and χ^2 test differences in proportions. $P < 0.05$ was considered significant.

TABLE 1
Tribal distribution of Ghanaian diabetic patients

Ethnic group	*No.*	*%*
Twi-speaking	250	54.8
Fantes	30	6.6
Guans	38	8.3
Ga-Adangbes	40	8.8
Northern extraction	66	14.5
Ewes	23	5.0
Others	9	2.0
Total	456	100.0

Results

Insulin-requiring diabetes patients were 112 (24.6 %) including 52 (11.4%) who were on insulin only and 60 (13.2%) who were on both insulin and oral hypoglycaemic drugs (Table 2). Non-insulin requiring diabetic patients were 344 (75.4%). Male insulin-requiring diabetic patients were 32 (22.6 %) including 16 (11.3%) who were on insulin only and 16 (11.3%) who were on both insulin and oral hypoglycaemic drugs. Male non-insulin requiring diabetic patients were 109 (77.3%). Female insulin-requiring diabetic patients were 80 (25.4 %) including 36 (11.4%) who were on insulin only and 44 (14.0%) who were on both insulin and oral hypoglycaemic drugs (Table 2). Female non-insulin requiring diabetic patients were 235 (74.6%).

The age of patient's ranged from 13 to 90 years with a mean of 55.8 ± 12.3 S.D. The age distribution (Table 3) shows that 43 (9.4%) of the diabetic patients were less than 40 years, 241 (52.9%) were in the 40 – 59 year group and 172 (37.7%) were

TABLE 2
Clinical and demographic characteristics of Ghanaian male and female diabetic patients

Clinical characteristics	*MalesN = 141*	*FemalesN = 315*	*P value*
Percentage (%)	30.9	69.1	0.001
Age (years)	55.4	56.0	0.62
Age of onset (years)	49.6	49.7	0.94
Duration (years)	5.8	6.1	0.60
BMI (Kg m^{-2})	24.1	25.6	0.029
Obese & Overweight (No./%)	47/33.3	156/49.5	0.001
Hypertension (No./%)	43/30.5	140/44.4	0.001
Preprandial glucose $mmoll^{-1}$	9.7	9.2	0.32
High preprandial glucose (No./%)	82/58.2	201/63.8	0.11
Insulin-requiring (No./%)	32/22.6	80/25.4	0.19
Non-insulin requiring (No./%)	109/77.3	235/74.6	0.22

more than 60 years. The age of males ranged from 15 to 85 years with a mean of 55.4 ± 12.2 S.D. That of females ranged from 13 to 90 years with a mean of 56.0 ± 12.4 S.D. (Table 3). The range of the age of onset of the disease was 10 to 89 years with a mean of 49.7 ± 12.5 S.D. The age of onset of disease (Table 3) showed that 6 (1.3%) of patients were less than 20 years (early onset), 42 (9.2%) were between 20 and 34 (intermediate onset), and 408 (89.5%) were more than 35 years (late onset). The age of onset of the disease in males ranged from 14.3 to 76.0 years with a mean of 49.6 ± 12.2 S.D. That of females ranged from 10 to 89 years, with a mean of 49.7 ± 12.6 S.D. (Table 2). The mean age of onset of the disease was 49.7 ± 12.5 years. Majority of the diabetic patients (89.5%)had the disease when they were more than 35 years, (late onset), a feature of type 2 diabetes mellitus. The mean age of onset in males (49.6 ± 12.2) and females (49.7 ± 12.6) were not significantly ($P = 0.94$) different.

The study showed that 86(18.9%) of patients had contracted the disease for more than 1 year, 276(60.5%) for between 2 and 9 years, 76(16.7%) between 10 to 19 years and 18(3.9%) for more than 20 years (Table 3). The duration for males ranged from 0.25 to 26 years, with a mean value of 5.8 ± 4.9 S.D. In females, the duration ranged from 0.25 to 30.0 years, with a mean value of 6.1± 5.6 S.D. (Table 2). The mean duration of diabetes in the population was 6.0 ± 5.4 years. There was no significant ($P = 0.60$) difference in the mean duration of diabetes between females (6.1 ± 5.6 years) and males (5.8 ± 4.9). More patients (60.5%) had contracted the disease for a duration of 1-9 years, reducing progressively to 3.9 per cent for disease duration of 20 years.

Preprandial glucose levels ranged from 2.9 to 30.2 mmol l^{-1}, with a mean value of 9.4±4.5. Sixty-eight (14.9%) had low preprandial glucose levels of less than 5.0 mmol l^{-1}, 105 (23.0%) had good preprandial glucose level of 5.0 to 7.2 mmol l^{-1}, whilst 283 (62.1%) had high preprandial glucose level of more than 7.2 mmol l^{-1} or inadequate blood glucose control (Table 3). In males preprandial glucose levels ranged from 3.1 to 30.2 mmol l^{-1},

TABLE 3
Clinical characteristics of 456 Ghanaian diabetic patients

Sex	Male	141 (30.9%)
	Female	315 (69.1%)
Age (yrs)	Mean	55.8±12.3
	< 40	9.4%
	40 -59	52.9%
	≥ 60	37.7%
Age of onset (yrs)	Mean	49.7±12.5
	< 20	13%
	20-34	9.2%
	≥ 35	89.5%
Duration of diabetes (yrs)	Mean	6.0±5.4
	< 1	18.9%
	1 " 9	60.5%
	10-19	16.7%
	≥ 20	3.9%
Preprandial glucose (mmol l^{-1})	Mean	9.4±4.5
	< 5	14.9%
	5.0 -7.2	23.0%
	> 7.2	62.1%
Basal metabolic index (Kg m^{-2})	Mean	25.1±4.8
	<18.5	0.7%
	18.5 – 24.9	54.8%
	25.0 – 29.9	23.2%
	≥30	21.3%
Hypertension	Confirmed, on medication	40.1%
	With controlled blood pressure (≥130/80 mmHg)	8.7%
	With inadequate blood pressure Control (≥130/80 mmHg)	91.3%
Insulin requiring status	Insulin requiring	24.6%
	Non-insulin requiring	75.4%

with a mean value of 9.7±5.2 S.D., whilst in females it ranged from 2.9 to 27.3 mmol l^{-1}, with a mean value of 9.2±4.2 S.D. Eighty-two (58.2%) males and 201 (63.8%) females had inadequate blood glucose control (Table 2).

Body mass index (BMI) values in diabetic patients ranged from 16.5 kgm^{-2} to 42.0 kg^{m-2}, with a mean of 25.1± 4.8 S.D. In males BMI ranged from 16.5 to 42.0 kg^{m-2}, with a mean of 24.1± 4.8 S.D. Twenty-three (16.3%) were obese and 24

(17.0%) were overweight. Basal metabolic index ranged from 16.0 to 39.8 kgm^{-2} in females with a mean of 25.6 ± 4.7. Seventy-four (23.5%) were obese and 82 (26.0%) were overweight (Table 2). The recommendations of the United States National Institute of Health were followed to classify patients as normal weight, overweight or obese. Three (0.7%) diabetic patients were underweight or had a BMI of less than 18.5 kgm^{-2}, 250 (54.8%) had normal BMI of 18.5 – 24.9 kgm^{-2}, 106 (23.2%) were overweight with a BMI of 25.0 – 29.9 kgm^{-2} and 97 (21.3%) were obese with BMI greater than or equal to 30.0 kgm^{-2} (Table 3). Body mass index (BMI) mean value of the studied diabetes mellitus population was 25.1 ± 4.8 kgm^{-2}, which on the average indicates overweight. It was revealed that a sizeable percentage of the diabetic patients were obese (21.3%) and overweight (23.2%). The percentage of female diabetics who were obese (23.5%) and overweight (26.0%) were significantly ($P = 0.001$; $P = 0.001$) higher than the corresponding values (16.3% and 17.0%) for male diabetics.

Diabetics with confirmed hypertension on medication were 183 (40.1%), the remaining 273 (59.9%) were without confirmed hypertension. Diabetics with hypertension on medication, whose blood pressures were less than 130/80 mmHg or had controlled blood pressure were 16 (8.7%), whilst those with blood pressure greater than or equal to 130/80 mmHg or inadequate blood pressure control were 167 (91.3%) (Table 3). Forty-three (30.5%) males and 140 (44.4%) females were diabetics with confirmed hypertension on medication (Table 2), whilst 98 (69.5%) males and 175 (55.6%) females were not hypertensive. The percentage of diabetic patients with confirmed hypertension in the study was 40.1%, and 91.3% of them had inadequate blood pressure control (≥ 130/80 mmHg). The percentage of female diabetics (44.4%) with hypertension was significantly ($P = 0.001$) higher than in males (30.5%).

Discussion

Out of 456 Ghanaian diabetic patients, the percentage of diabetics that were females (69.1%) was significantly ($P = 0.001$) higher than the percentage that were males (30.9%), giving a male to female ratio of 1:2.2. Therefore, there were more Ghanaian females with diabetes mellitus than males. This is consistent with the observation made by Wild *et al.* (2004) that, there are more women with diabetes mellitus than men. The combined effect of a greater number of elderly women than men in most populations and the increasing prevalence of diabetes mellitus with age are the most likely explanations for this observation. The spread of diabetes mellitus is across ethnic divide in Ghana.

The ratio of insulin-requiring diabetes mellitus patients (24.6%) to non-insulin requiring diabetes mellitus patients (75.4) was 1:3. Insulin dependency is the major clinical criterion for distinguishing between type 1 and type 2 diabetes. The percentage of insulin-requiring and non-insulin requiring patients were not significantly ($P = 0.19$, $P = 0.22$, respectively) different in males and females. The highest percentage (52.9%) of diabetic patients in the study was found in the age group, 40 – 59 years; the mean age of diabetics, 55.8 ± 12.3 years further attests to this fact. However, a sizeable percentage (37.7%) were 60 years or more. This trend compares favourably well with earlier findings, which show that, the prevalence of diabetes mellitus increases with age for both males and females. Further in developing countries, the majority of people with diabetes mellitus are in the 45 – 64 year group (King *et al.*, 1998; Wild *et al.*, 2004).

Mean preprandial glucose level for the studied diabetes mellitus population was 9.4±4.5 mmol l^{-1}. A large percentage (62.1%) of the Ghanaian diabetics had a high preprandial glucose level (>7.2 mmol l^{-1}) or inadequate blood glucose control, which is outside the near-normal levels

(5.0 – 7.2 mmol l^{-1}) recommended by American Diabetic Association (2004) for diabetic patients. The percentage (58.2%) of males with inadequate blood glucose control was not significantly (P = 0.11) different from that of females (63.8%). Maintaining near-normal glucose levels minimizes the risks for both hyper- and hypoglycaemic episodes, and for a long time minimizes the risk for microvascular diabetic complications (Goldstein *et al.*, 2004).

Obesity characterised by excess body fat is probably the most notable risk factor for the development of type 2 diabetes (Edelstein *et al.*, 1997). It is estimated that the risk for type 2 diabetes attributable to obesity is as high as 75 per cent (Manson & Spelsberg, 1994). Thus, the higher percentage of Ghanaian female diabetics was probably as a result of obesity and type 2 diabetes. Geiss *et al.* (2002) reported that 71 per cent of all adults in the USA with diabetes were hypertensive, a fraction that is higher than the value in Ghana. Nevertheless, the percentage of uncontrolled blood pressure at Komfo Anokye Teaching Hospital is worrying. This is because the coexistence of hypertension and diabetes mellitus is pernicious as a result of strong linkage of the two conditions with cardiovascular disease (Fagan & Sowers, 1999), stroke (Davis *et al.*, 1999), progression of renal disease (Maki *et al.*, 1995) and diabetic retinopathy.

Conclusion

There were more Ghanaian females with diabetes mellitus than males and more non-insulin requiring than insulin-requiring patients. About 90.6 per cent of the Ghanaian diabetic patients were 40 years and above and had late onset of diabetes. Also, 60.5 per cent of patients had diabetes with duration of 1-9 years and inadequate blood glucose control. Again, 39.4 per cent of them were obese and overweight and hypertensive with values in females higher than in males. Almost all of the hypertensive (91.3%) patients did not achieve adequate blood pressure control.

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