



Research Article

BLOOD GLUCOSE CONTROL AND ITS DETERMINANTS

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ABSTRACT

Diabetes is a complex disorder that requires constant attention to diet, exercise, glucose monitoring, and medication to achieve good glycemic control. Diabetes affects up to 10 % of the population aged 20 years and older. This rate may be doubled if those with impaired glucose tolerance (IGT) are also included. The manifestations of diabetes cause considerable human suffering and enormous economic costs. Both acute and late diabetic complications are commonly encountered. The objective of this study was to assess glycemic control for DM patients attending Hiwot Fana University Hospital Harar Ethiopia. Institutional based cross-sectional study was employed. Data was collected from DM patients of chronic OPD with regular follow up, who were treated during the period from September 20, 2013 to September 20, 2014. Well-structured data extraction format was developed and used to collect the data. Data from the total of 384 patients' card was collected. The data entry was done by Epi data and analyzed by using the Statistical Package for the Social Sciences (SPSS), version 16.0. Frequency, cross tabs, binary regression and multivariate analysis was done. 384 patients were studied and 194 (50.5 %) of them were male. 277 (72.1 %) of patients had type 2 DM. On the other hand from the total of the participants 154 (40.1 %) had co-morbid conditions, from this 45 (11.7 %) of them had cardiovascular disease. Among all participants 33 (8.6 %) were diagnosed with micro-vascular complications, from these, majority 19 (4.9 %) had neuropathy. From the total of participants, 14 (3.6) had acute complication, from these 12 (3.1 %) had DKA. Of all participants only 9 (2.3 %) and 12 (3.1 %) were undergo lipid and renal function test respectively. 71 (18.5 %) had good glycemic Control, while significant proportion of patients 313 (81.5 %) had poor glycemic control. 154 (40.1 %) of participants had concomitant disease 26 (32 %) of them had no appropriate drug selection for the co-morbid conditions. The glycemic control of patients in this study was very poor. Laboratory tests which will assist in the diagnosis of complications and control of diabetes mellitus like lipid profile and renal function tests were rarely done.

Keywords: blood glucose, renal function test, lipid profile test, appropriate drug selection

INTRODUCTION

Diabetes is a complex disorder that requires constant attention to diet, exercise, glucose monitoring and medication to achieve good glycemic control. Factors contributing to optimum management of disease like diabetes included age, complexity of treatment, duration of disease, depression and psychosocial issues¹. Studies have also demonstrated that, in some countries, diabetes affects up to 10 % of the population aged 20 years and older. This rate may be doubled if those with impaired glucose tolerance (IGT) are also included. The manifestations of diabetes cause considerable human suffering and enormous economic costs. Both acute and late diabetic complications are commonly encountered. Long-term complications represented by cardiovascular diseases, cerebro-vascular accidents, end-stage renal disease, retinopathy and neuropathies are already major causes of morbidity, disability and premature death in developing countries². Management of diabetes mellitus and its complications presents an increasing challenge to health care systems throughout the world. Diabetes is also the fourth leading cause of death in developing countries³. Diabetes is not uncommon in Ethiopia but the incidence and prevalence of the disease is not well known in the community. Limited studies have shown a significant increase in its prevalence over the last four decades, poor access to diabetes care and high rates of chronic complications. In one of the recent studies, accesses for blood glucose monitoring and diabetes health education were found to be very low⁴. Therefore, the objective of this study was to assess glycemic control and its' determinants in Hiwot Fana Specialized University Hospital (HFSUH), Harar, Eastern Ethiopia.

METHODS AND MATERIALS

Study area and design

Harar is one of the nine regional states that are located in Eastern part of Ethiopia which is 526 km away from the capital Addis Abeba. The region has four governmental, 2 private hospitals and 7 health centers. Hiwot Fana Specialized University Hospital (HFSUH) was established during the invention of Italy to provide medical service for the solders. But later on it become one of the public hospitals. Since July 29, 2010, the hospital incorporated into Haramaya University College of Medical and Health Sciences. The hospital gives service for more than 5,000,000 populations from Harari, Oromia, Somalia and some parts of Dire Dawa.

The study design

Institutional based retrospective cross sectional study was used.

Source population

The source of population was diabetic patient whose follow-up was in HFSUH

Study Populations

The study population was diabetic's patient who had follow-up from September 20, 2013 to September 20, 2014 in HFSUH.

Inclusion and Exclusion criteria

Inclusion criteria

All cards of DM patients which were seen from September 20, 2013 to September 20, 2014 in chronic OPD of HFSUH were included.

Exclusion criteria

Cards for DM patients aged less 18 years.

Sample size determination and sampling technique

A sample size of 384 was determined using the formula for single population based on the assumption of in the absence of previous prevalence of data on the population under study to obtain the max sample size P was assumed to be 0.5. Moreover, the margin of error of 5 %, confidence interval of 95 % -assumed ($Z/2 = 1.96$).

$$K = N/n \quad 1152/384 = 3 \quad k = 3$$

n = sample size, N = total DM patient (from September 20/2013-september 2014), K = interval

Data collection instruments and procedures**Data collection instruments**

Data was collected using pretested cheek list. The check list was pretested on 10 patient cards that were not included in sampling. Poor glyceamic control was identified by using American diabetic association recommendation for target blood glucose level: fasting blood glucose level 70 mg/dl-130 mg/dL or peak postprandial \leq 180 mg/dL. HbA_{1C} was not used because it was not done in the town.

Data collection procedures

After consent of hospital administrator's cards of patients seen in one year was collected and the cards were numbered first. Then, the sample was taken by using systematic random sampling. The important information was taken by a pre prepared cheek list. Three 5th year pharmacy students were involved in data collection. The principal investigators gave training on how to collect data for the data collectors for two days and were supervising data collectors during the data collection process.

Data quality control

After the completion of each cheek list, cross checking was done to assure the completeness of the information gathered.

Variables**Dependent variables**

Glyceamic control for DM

Independent variables

- Age
- Sex
- Organ function test
- Lipid profile test
- Co-morbid disease conditions
- Acute complications of DM
- Type of DM

Data analysis

After data collection process, every questionnaire rechecked for completeness and consistency of the collected data. The data was entered in Epi data version 3.1 and transferred to SPSS version 16.0. Frequencies, percentages, cross tabs and logistic regression was done to identify associated factors. In the logistic regression first each dependent variable was run to find crude odds ratio (COR) and only those variables which had significant COR value were run together to find the adjusted odds ratio (AOR).

Ethical considerations

Formal letters of cooperation was written form Haramaya University College of Health and Medical Sciences. Confidentiality of information's was maintained by avoiding patients name and address during data collection.

RESULT**Socio-demographic characteristics**

A total of 384 DM patients' card, which was selected from chronic OPD, was included in the study. From the total study participants 194 (50.5 %) were male. The mean age of study participants were 40.13+ 13.59 (Table 1).

Diagnosis, treatment and follow-up

Of 384 participants 277 (72.1 %) had type 2 DM. On the other hand from the total of the participants 154 (40.1 %) had co-morbid conditions, from this 45 (11.7 %) of them had cardiovascular disease. Among all participants 33 (8.6 %) were diagnosed with micro-vascular disease, from these, 19 (4.9 %) had neuropathy. From the total of participants, 14 (3.6 %) had acute complication, from these 12 (3.1 %) had diabetic keto-acidosis (DKA). Of all participants only 9 (2.3 %) and 12 (3.1 %) were undergo lipid profile and renal function tests respectively. About 24 (6.2 %) participants had unknown follow-up date and duration of current medication (Table 2).

Blood glucose control and appropriate drug selection for concomitant disease

Of 384 study participants 71 (18.5 %) had good glyceamic control, while significant proportion of patients 313 (81.5 %) had poor glyceamic control. About 154 (40.1 %) participants had concomitant disease 26 (32 %) of them had no appropriate drug selection (Table 3).

Co-morbid conditions and inappropriately selected drugs with appropriate first line options

From the total of 384 participants 154 (40.1 %) had concomitant disease and inappropriate drug was selected in 26 (3.2 %) of them. The co-morbid disease conditions with inappropriate drug selection were hypertension, diabetic diarrhea and depression; HCT, Ciprofloxacin and amitriptyline were inappropriately selected drugs respectively (Table 4).

Associated factors for blood glucose control

Patients who had cardiac co-morbid conditions were 5.079 times more likely to have controlled blood glucose level than patients who had non-cardiac co-morbid conditions (AOR = 5.079(1.868- 13.824). Type of diabetes mellitus was found to be significant associated factor by COR but not by AOR (Table 5).

DISCUSSION

Diabetes mellitus had equal distribution by sex (female = 190 and male = 194) according to the current study. 277 (72.1 %) of the patients had type-2 DM while the rest 107 (27.9 %) had type-1 DM. 154 (40.1 %) had co-morbid conditions; 45 cardiovascular, 104 non cardiovascular and 5 of them both cardiovascular and non cardiovascular co-morbid conditions. Micro-vascular complications occur in 33 (8.3 %) patients; 19 neuropathy, 10 retinopathy and 4 nephropathy.

Table 1: Socio-Demographic Characteristics of Diabetes Mellitus Patients in HFSUH

Socio-demographic variables		Frequency (%)
Sex	Female	190 (49.5)
	Male	194 (50.5)
Age	15-19	22 (5.7)
	20-24	25 (6.5)
	25-29	36 (9.4)
	30-34	57 (14.8)
	35-39	38 (9.9)
	40-44	67 (17.4)
	45-49	24 (6.3)
	50-54	49 (12.8)
	55-59	14 (3.7)
	60-64	37 (9.6)
>65	15 (3.9)	

Table 2: Diagnosis, Treatment and Follow-Up of Diabetes Mellitus Patients in HFSUH

Diagnosis, treatment and follow-up variables		Frequency (%)
Type of DM	Type-1	107 (27.9)
	Type-2	277 (72.1)
Co-morbid condition	Yes	154 (40.1)
	No	230 (59.9)
Type of co-morbid condition	Cardiovascular	45 (11.7)
	Non-cardiac	104 (27.9)
	Cardiac+non-cardiac	5 (0.5)
Micro vascular complication	Yes	33 (8.6)
	No	351 (91.4)
Type of micro vascular complications	Neuropathy	19 (4.9)
	Retinopathy	10 (2.9)
	Nephropathy	4 (1.0)
Acute complication	Yes	14 (3.6)
	No	370 (96.4)
Type of Acute complication	DKA	12 (3.1)
	Hypoglycemia	2 (0.5)
Lipid profile test	Yes	9 (2.3)
	No	375 (97.7)
Renal function test	Yes	12 (3.1)
	No	372 (96.9)
Follow up date known	Yes	360 (93.8)
	No	24 (6.2)

Table 3: Blood Glucose Control and Appropriate Drug Selection for Concomitant Disease of Diabetes Mellitus Patients in HFSUH

Blood glucose and drug selection for co-morbid condition		Frequency (%)
Blood glucose level controlled	Yes	71 (18.5)
	No	313 (81.5)
Appropriate drug selection for concomitant disease	Yes	128 (83.1)
	No	26 (16.9)

Table 4: Co-Morbid Conditions and Inappropriately Selected Drugs with Appropriate First Line Options of Diabetes Mellitus Patients in HFSUH

Concomitant disease (frequency)	Inappropriate drug	Appropriate first line option
Hypertension and CKD (12)	HCT	ACEI
Diabetic diarrhea (9)	Ciprofloxacin	Doxycycline or metronidazole
Depression (5)	Amitriptyline	SSRI

Table 5: Associated Factors for Blood Glucose Control for Diabetes Patients in HFSUH

Associated factors		Blood glucose controlled		COR(CI)	AOR(CI)
		Yes	No		
Sex	Female	38	152	1.220 (0.728-2.044)	
	Male	33	161	1	
Age				0.989 (0.970-1.009)	
				1.929 (1.124-3.310)*	
Type of DM	Type-1	28	79	1	2.225 (0.752-6.583)
	Type-2	43	234	1	
Anti-Diabetic regiment	Oral hypoglycemic agents only	32	165	0.736 (0.439-1.235)	
	Insulin based regiment	39	148	1	
Co-morbid conditions	Yes	22	132	0.620 (0.358-1.076)	
	No	49	181	1	
Type of co-morbid condition	Cardiac	13	34	4.163 (1.634-10.607)*	5.079 (1.868-13.824)**
	Non- cardiac	9	98	1	

COR = crude odds ratio, AOR = adjusted odds ratio, *significant by crude odds ratio, **significant by adjusted odds ratio

Hypertension and diabetic neuropathy were also found to be the most common complication in Uganda⁵. 14 (3.8 %) of patients had acute complication which lead to hospital admission on the review period; 12 of them had diabetic keto acidosis and 2 had hypoglycemia. Lipid profile and renal function tests were done only for 9 and 12 of patients, respectively. In South Africa also lipid examination was rarely performed⁶. In Jimma, South Western part of Ethiopia, about half of the patients didn't have urine analysis, renal function and lipid test done in the previous 1-2 years and none ever had glycosylated hemoglobin (HbA_{1c}) determination⁴. The blood glucose level was controlled only in 71 (18.5 %) of patients while the rest 313 (81.5 %) had uncontrolled blood glucose level. In Jimma, South Western part of Ethiopia, 81.7 % had poor glycemic control⁷. This similarity in poor glycemic control is an indication for a need to prompt action and commitment of physicians and clinical pharmacists in the country. 26 (16.9 %) of patients with co-morbid condition had inappropriate selection of drugs for the co-morbid condition. Selection of hydrochlorothiazide for hypertension with chronic kidney disease, selection of ciprofloxacin for diabetic diarrhea and selection of amitriptyline for major depression without neuropathy were the inappropriate drug selections identified. Patients who had cardiac co-morbid conditions were 5.079 times more likely to have controlled blood glucose level than patients who had non-cardiac co-morbid conditions (AOR = 5.079(1.868-13.824). The positive effect of having cardiovascular co-morbid condition on blood glucose control might due to an increase follow-up frequencies for patients with cardiovascular disease. A study conducted in eight European countries had also identified having one or more macro vascular complication as likely hood factor for having target HbA_{1c}⁸. Generally, the glycemic control of patients in this study was very poor. Laboratory tests which will assist in the

diagnosis of complications and control of diabetes mellitus like lipid profile and renal function tests were rarely done.

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