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Predictors of Glycaemic control among Adults attending a diabetic Outpatient clinic in a Tertiary hospital, Tanzania: A cross sectional study

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Abstract

Background

The burden of diabetes mellitus is increasing worldwide and especially so in developing countries. Poor control of diabetes mellitus is associated with the development and progression of many chronic diseases. Proper glycaemic control is important to prevent the development and progression of these complications. In this study, we aimed at assessing the status of glycaemic control and identifying predictors of good glycaemic control among patients with diabetes mellitus type 2 attending an outpatient clinic in Kilombero district, Tanzania.

Methods

This study was a prospective, clinic based, cross-sectional study conducted between August and October 2014 at the St. Francis Referral Hospital diabetic outpatient clinic in Ifakara. A systematic, random sample of 221 patients was enrolled for the study. Socio-demographic and clinical characteristics were collected using a structured questionnaire and a data-collecting tool was used to record the laboratory and clinical measurements. Fasting blood glucose was measured in all patients and the level of ≤7.2mmol/dl was considered good glycaemic control. Logistic regression was used to assess association between different variables and glycaemic control.

Results

Out of the 221 patients involved in the study, 65 (29.4%) had good glycaemic control. Factors associated with good glycaemic control included having received diabetes education (OR [95% CI] = 13.8 [5.95-31.9], p = < 0.001), engaging in regular physical exercise (OR [95% CI] = 5.26 [1.95-14.2], p=0.001), having health insurance (OR [95% CI] = 2.44 [1.08-5.49], P = 0.03) and the use of monotherapy (OR [95% CI] = 7.24 [1.70-30.8], p= 0.007). Duration of diabetes, age and BMI were not associated with glycaemic control in this study.

Conclusion

The majority of patients had poor glycaemic control in this population. Health care resource allocation to diabetes and counseling patients to engage in physical activity are important to improve glycaemic control in type 2 diabetic patients.

Keywords: Type 2 diabetes, Glycaemic control, Tanzania

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Introduction

Tanzania, like many other African countries, has witnessed a significant rise in diabetes mellitus (DM) cases. In the year 2000, the prevalence of DM in Tanzania was estimated to be 1.3% in rural areas and 4% in urban centers (1). The Tanzania Diabetes Association estimated that there were 1.7 million cases of DM in Tanzania in 2014, with an estimated prevalence of 8% in adults (2). The World Health Organization (WHO) projects that the number of cases of diabetes will rise to 300 million by 2025, with the majority of these cases being found in Africa and Asia (3). In sub-Saharan Africa, it is estimated that the number of cases of DM will rise to 18 million by 2030 (4).

In patients with diabetes, hyperglycaemia has been associated with the development and progression of a variety of diabetic complications (5). The importance of glycaemic control in the management of DM has been well established. Tight glycaemic control has been shown to reduce the risk of microvascular complications in both type 1 and 2 DM (6,7). Despite this fact, attaining sustained glycaemic control has not been achievable for most diabetic patients (5,8).

Despite the well-established evidence of the association between poor glycaemic control and the development and progression of diabetic complications (5–7), little is known about factors associated with achieving and maintaining the recommended levels of blood sugar in diabetic patients. Some of the factors that were found to predict poor glycaemic control in other studies include the duration of diabetes, obesity, the use of more than one drug, poor adherence to the medication, insufficient education on the disease, young age at initial diagnosis and, in some studies, the fear of hypoglycemia (9–13). In Tanzania, despite the increasing burden of diabetes, data on factors associated with glycaemic control is scarce. This study is aimed at determining the status of glycaemic control and identifying the predictors for good glycaemic control among diabetic patients attending an outpatient clinic in a tertiary level hospital.

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Methods

Study design

This was a descriptive, cross-sectional study conducted between August and October 2014.

Study setting

The study was carried out at the diabetic outpatient clinic at St Francis Referral Hospital, Ifakara-Kilombero district, Tanzania. St Francis Hospital, Ifakara is one of the referral tertiary level hospitals in Tanzania owned by the Roman Catholic Church, Mahenge diocese, catering for about 600,000 people. The outpatient department attends to approximately 100,000 patients annually. The diabetic clinic was established in 2010. Currently, it has a total of 551 patients and attends to patients twice a week. The average attendance is 37 patients per week. Patients attend the clinic at appointed times determined by healthcare providers for continuous monitoring.

Study participants

The study included 221 type 2 diabetic patients aged 18 years and above attending the diabetic clinic at St Francis Hospital, Ifakara. The patients were sequentially enrolled until the sample size was reached. Patients with acute illness, critical illness, mental disorders, newly diagnosed patients, those who were on medication for <3 months and those who did not consent were excluded from the study. The purpose of the study was explained to the patients and then they were asked to participate in the study. Patients who consented to participate were then interviewed using a structured questionnaire.

Data collection and laboratory analysis

Demographic variables and clinical characteristics were recorded using a structured, pre-tested questionnaire. For each patient who consented for the study, the fasting blood sugar was tested using GlucoPlus glucose monitoring system (Montreal, Canada). The patient's weight and height were also measured and the body mass index (BMI) was calculated. A data collection tool was

used for recording the blood sugar level, the weight, height and BMI, type of medications and any history of co-morbidities.

Data analysis

Continuous variables were summarized by medians and interquartile ranges (IQRs) and categorical variables were summarized by frequency and percentage. Associations between factors and the endpoint were summarized with odds ratios (ORs) and 95% confidence intervals (CIs) with associated p-values. Two-way hypotheses/confidence intervals were used for all calculations. Data was analyzed using StataIC/10.1 (College Station, Texas). The dependent variable was dichotomized with fasting blood glucose (FBG) of ≤7.2 mmol/dl considered as good glycaemic control and >7.2 mmol/dl considered as poor glycaemic control. Multiple logistic regression analysis was performed to control for possible confounding variables. Those variables which showed association on bivariate analysis at (P value < 0.2) were fitted into the model by stepwise (forward selection) method for being adjusted to each other in order to identify independent associated variables.

Ethical issues

The study was approved by the University of Dodoma's ethical review committee. Permission to conduct the study was also obtained from the management of St Francis Hospital, Ifakara. Only patients who consented for the study were enrolled. Confidentiality was ensured during all stages of this study.

Results

Patient characteristics

221 patients were enrolled for the study. Among the 221 patients involved in the study, 38% were males and 62% females. The median age was 56 years (50-63).The majority of the study participants were either married or cohabiting (64.3%), while 14% were single and 11.7% were separated, divorced or widowed. Most of the patients had a primary level of education (57%),

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while 17.7% of the patients had no formal education. About 52.9% of the patients have been known to have diabetes for <5 years, while 33% have diabetes for ≥10 years. Only 64 patients (29%) reported to have received diabetes education. Most of the enrolled patients (73.3%) were on monotherapy, whereas 26.7% of the patients were on combination therapy. Only 65 patients (29.4%) had health insurance. A summary of socio-demographic and baseline characteristics is provided in **table 1**.

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Table 1: Baseline socio-demographic and clinical characteristics of the respondents attending diabetic outpatient clinic at St Francis Referral Hospital, Ifakara, 2014 (N=221)

Variable	Frequency	Percentage
Age years (Mean 56.4, SD 10.9)		
<46	31	14.03
46-60	120	54.30
≥61	70	31.67
Sex		
Female	137	61.99
Male	84	38.01
Marital status		
Single	31	14.03
Married/Cohabiting	142	64.25
Widow/Separated/Divorced	48	11.72
Educational status		
None	39	17.65
Primary	126	57.01
Secondary	17	7.69
Tertiary	39	17.65
Occupation		
Peasant	132	59.73
Housewife/man	32	14.48
Employed	39	17.65
Self-employed	18	8.14
Duration of DM		
<5 years	117	52.94
5-9 years	31	14.03
≥10 years	73	33.03
Receiving DM education		
Yes	64	28.96
No	157	71.04
BMI (Mean 28.10, SD 5.58)		
Underweight	7	3.17
Normal	50	22.62
Overweight	90	40.72
Obese	74	33.48

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Factors associated with good glycaemic control

Out of 221 patients involved in the study, 65 (29.4%) had good glycaemic control defined as a FBG ≤ 7.2 mmol/dl. After multivariate analysis, good glycaemic control was significantly associated with self-reporting of doing some physical exercise (OR [95% CI] = 5.26 [1.95-14.2], p=0.001), monotherapy treatment (OR [95% CI] = 7.24 [1.70-30.8], p= 0.007), having received diabetes education(OR [95% CI] = 13.8 [5.95-31.9], p = < 0.001) and having health insurance (OR [95% CI] = 2.44 [1.08-5.49], P = 0.03). Male sex was significant using univariate analysis, but was not significant with multivariate analysis. Results showing association between clinical characteristics and good glycaemic control with univariate and multivariate analysis are summarized in **table 2**.

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Table 2: Socio-demographic and clinicalfactors predicting glycaemic control among Type 2 diabetic patients attending diabetic outpatient clinic at St Francis referral Hospital, Ifakaram, 2014(N=221)

Predictor	Good glycaemic control N (%)	Poor glycaemic control N (%)	OR [95% CI]	AOR [95% CI]
Age group				
<46	7 (10.77)	24 (15.38)	1.00	1.00
46-60	33 (50.77)	87 (55.77)	1.30 [0.51-3.30]	
≥61	25 (38.46)	45 (28.85)	1.90 [0.72-5.04]	2.16 [0.93-5.03]
Sex				
Male	29 (44.62)	55 (35.26)	1.48 [0.82-2.66]	1.36 [0.61-3.90]
Female	36(55.38)	101 (64.74)	1.00	1.00
Marital status				
Living with partner	45 (69.23)	97 (62.18)	1.37 [0.74-2.53]	
None	20 (30.77)	59 (37.82)	1.00	
Educational status				
None	11 (16.92)	28 (17.95)	1.00	
Primary	41 (63.08)	85 (54.49)	1.23 [0.56-2.71]	
Secondary	7 (10.73)	10 (6.41)	1.78 [0.54-5.86]	
Tertiary	6 (9.23)	33 (21.15)	0.46 [0.15-1.41]	
Occupation				
Peasant	38 (60.26)	94 (58.46)	1.00	
Housewife/man	8 (15.38)	24 (12.31)	0.82 [0.34-2.00]	
Self employed	13 (16.67)	26 (20.00)	1.23 [0.58-2.66]	
Employed	6 (7.69)	12 (9.23)	1.24 [0.43-3.53]	
DM duration				
<5 years	46 (70.77)	71 (45.51)	2.51 [1.27-4.94]	1.40 [0.60-3.30]
5-9 years	4 (6.15)	27 (17.31)	0.57 [0.17-1.89]	
≥10 years	15 (23.08)	58 (37.18)	1.00	1.00
Receive DM education				
Yes	43 (66.15)	21 (13.46)	12.56 [6.33-24.95]	**13.78 [5.95-32.22]**
No	22 (33.85)	135 (86.54)	1.00	1.00
Type of drugs				
One	62 (95.38)	100 (64.10)	11.57 [3.67-39.29]	**7.24 [1.70-31.88]**
More than one	3 (4.62)	56 (35.90)	1.00	1.00
Who cover the Cost				
Insurance	43 (66.15)	68 (43.59)	2.53[1.39-4.61]	**2.44 [1.08-5.49]**
No Insurance	22 (33.85)	88 (56.41)	1.00	1.00
BMI classification				
Normal/underweight	11 (16.93)	46 (29.49)	1.00	1.00
Overweight	31 (47.69	59 (37.82)	2.20 [1.00-4.29]	2.59 [0.93-7.18]
Obese	23 (35.38)	51 (32.69)	1.89 [0.83-4.29]	1.32 [0.45-3.83]
Exercise				
Yes	23 (35.38)	20 (12.82)	3.72 [1.86-7.40]	**5.26 [1.95-14.19]**
No	42 (64.62)	136 (87.18)	1.00	1.00

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Discussion

Like many developing countries, Tanzania is experiencing an increasing burden of DM. DM is associated with macrovascular and microvascular complications, especially when there is poor control of blood sugar (5). Studies have shown that very few patients achieve the recommended glycaemic control (8). According to American diabetes association (ADA)(2009) (14), the gold standard method for monitoring glycaemic control is by measuring glycosylated haemoglobin (Hb1c). However, in many resource-limited settings like Tanzania, this is not readily available. Studies have shown that there is a correlation between Hb1c levels and the fasting or post-prandial blood glucose levels, both of which are less costly (15,16). In this current study, we used the FBG as a marker of glycaemic control and assess factors associated with good control.

Similar to most other previous studies in developing countries (10,13), few of our patients (29.4%) had good glycaemic control. Similar findings were also obtained in a study done at three government hospitals in Dar es Salaam where only 30.3% of the patients had good glycaemic control defined as FBG ≤ 7.2 mmol/dl (12). Reports from developed countries are conflicting. While some studies have reported higher rates of glycaemic control (17–19), there are also reports of low rates of glycaemic control as well (20,21).

In our study, good glycaemic control was associated with having received diabetes education. This is similar to studies elsewhere, which found improvements associated with the level of education about the disease (22,23). Knowledge about DM and therapeutic interventions have been found to improve adherence to treatment and better glycaemic control. On the contrary, lack of knowledge on the medication and disease condition are associated with poor adherence to treatment (24).

In our study, drug utilization pattern was also found to be associated with glycaemic control. Good glycaemic control was significantly associated with the use of monotherapy as opposed to the use of combination therapy. The most likely reason is better treatment adherence with monotherapy. With combination therapy, there is either increased pill burden or the

inconvenience of injecting insulin, both of which can compromise adherence. Because diabetes is a progressive and chronic disease, more drugs may be added when glucose levels are found to be high during follow up and this may also cause the observed association. Several studies have also supported these findings (10,12). One study, however, showed that drug utilization pattern does not affect adherence to medication (25).

The health benefits of physical exercise in patients with type 2 DM has been clearly defined (26–28). Guidelines for the management of DM outline physical exercise as one of the non-pharmacological measures in the management of DM (14). In our study however, only 43 patients 19.5% reported participating in some form of physical exercises. Participation in regular physical exercises was significantly associated with good glycaemic control. Our finding is similar to the findings in other studies (29,30). This could be explained by the fact that exercise reduces insulin resistance in type 2 DM (26).

Unlike findings in other studies (10,20,21,31), we found no association between glycaemic control and age of the patients in our study. Other studies (10,12,31) have also found association between glycaemic control and the duration of diabetes. However, in our study the duration of DM had no association with glycaemic control.

Insurance status has had opposing findings in previous reports, with some showing association between having health insurance and good glycaemic control (9,12,32) while other studies found no such association (33,34). In this study, having health insurance was associated with good glycaemic control. In communities with low socio-economic status like our study setting, health insurance has been found to be associated with good glycaemic control (9). This could be explained by the fact that a majority of our study participants had no reliable or continuous source of income to care for a disease that requires close monitoring and regular follow-up. Having health insurance provided a reliable means of getting the required services.

Some limitations for this study include the failure to perform glycosylated haemoglobin analysis, which is the gold standard for determining glycaemic control. The level defining good glycaemic

control using other less costly measures (fasting and post-prandial blood glucose) is not as clearly defined. Some confounding factors of blood sugar level, such as diet and quantification of sugar intake, were not done in this study. Also, patients were enrolled from a single clinic; the results may not be generalizable. Finally, the study had a relatively small sample size.

Conclusion

Our study indicates that the majority of patients attending the diabetic clinic at St Francis Referral Hospital have poor glycaemic control. The use of monotherapy, engaging in regular physical activity and having received diabetes education were significantly associated with good glycaemic control in this population. Our findings outline the importance of providing health education and encouraging physical exercises in type 2 diabetics to achieve glycaemic control.

Competing interests

The author(s) declare that they have no any competing interests.

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