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RESEARCH

Central obesity is an independent risk factor of poor glycaemic control at Dr George Mukhari Academic Hospital

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Background: Results of previous studies on the effect on glycaemic control of anthropometric measures of obesity, some economic status variables and the presence of metabolic syndrome are not consistent and appear to differ among health institutions. The status of glycaemic control and some of its determinants was investigated among adult black patients with type-2 diabetes mellitus (T2DM) at Dr George Mukhari Academic Hospital (DGMAH).
Method: A random sample of 176 adult black South African patients with T2DM attending the diabetic clinic at DGMAH was investigated in the current study. Fasting blood glucose, glycated haemoglobin (HbA1c), lipid profile components levels as well as anthropometric measures of obesity were measured using standard measuring procedures for these variables. The presence of metabolic syndrome was assessed according to the International Diabetic Federation criteria. Information related to patients' socioeconomic status was collected by means of a structured questionnaire. Associations between these factors and poor glycaemic control were assessed by means of binary and multivariate logistic analysis.
Results: Glycaemic control was found to be very poor at DGMAH. As low as 16.6% of the study subjects achieved SEMDSA's 2012 recommended target HbA1c value of less than 7.0%. Whereas binary logistic analysis revealed that marital status, matriculation, increase waist circumference and duration of diabetes > 5 years may lead to poor glycaemic control, multivariate logistic regression analysis indicated that only increased waist circumference was independently associated with poor glycaemic control at DGMAH.
Conclusions: Central obesity appears to be an independent risk factor for poor glycaemic control among T2DM patients at DGMAH.

Keywords: central obesity, determinants of poor glycaemic control, type 2 diabetes mellitus

Introduction

Evidence from randomised controlled clinical trials suggests that tight glycaemic control reduces the incidence of long-term complications of diabetes.[1–3] However, despite this evidence, sustained glycaemic control remains an elusive goal for many type 2 diabetes (T2D) patients throughout the world.[4,5] In agreement with this observation, a number of previous research studies conducted in South Africa have reported that glycaemic control is very poor in some South African health institutions. In this context, Erasmus *et al.*[6] assessed long-term glycaemic control in T2DM patients attending the diabetic clinic at a peri-urban community study in Umtata, Eastern Cape province and found that only 19.9% of their study subjects achieved recommended target HbA1c value of less than 7.0%. In addition, Rotchford and Rotchford[7] investigated the level of glycaemic control among T2DM patients in a rural South African black community of KwaZulu-Natal and reported that, in general, glycaemic control was very poor in that community, with an average HbA1c level of 11.3%. Furthermore, in their investigation of the level of glycaemic control among mostly T2DM black patients at three tertiary Johannesburg hospitals associated with the University of Witwatersrand, Klisiewicz and Raal[8] found and reported an average HbA1c level of 8.7% among their study subjects. These authors also reported that the observed HbA1c level of 8.7% was 2.7% higher than the level of glycaemic control (HbA1c < 7.0%) recommended by SEMDSA[9] guidelines for management of T2DM.

Glycaemic control is known to be influenced by a number of factors, which can be categorised into several groups including: patient-related factors (e.g. ethnicity, age, gender and non-adherence to medication),[10] disease-related factors (e.g. longer duration of diabetes and the presence of metabolic syndrome),[11] treatment-related factors (e.g. physical inactivity and monotherapy with oral hypoglycaemic agents),[12] healthcare provider-related factors (e.g. reluctance to start exogenous insulin therapy),[13] health facility-related factors (e.g. lack of certain types of medications or staff shortage)[14] and socioeconomic factors (e.g. employment status, income and level of education).[15] Although some determinants of poor glycaemic control such as longer duration of diabetes and non-adherence to medication have been consistently associated with poor glycaemic control in research studies,[14–16] results of studies on the effect of factors such as anthropometric measures of obesity, some economic status variables and the presence of metabolic syndrome on glycaemic control are not consistent and appear to differ among health institutions and/or research settings.[14,17] Also, there are few studies that have investigated the effects of socioeconomic factors, healthcare provider and health facility-related factors on glycaemic control. Thus, the aim of this cross-sectional, hospital-based study was to investigate the status of glycaemic control and some of its determinants among adult black T2DM patients at DGMAH, Gauteng Province, Republic of South Africa.

Methodology

Study design, setting and sample

This cross-sectional hospital-based study was conducted at Dr George Mukhari Academic Hospital (DGMAH), a tertiary hospital in the Gauteng province of the republic of South Africa that caters for mostly black African patients and serves as a medical training site for Sefako Makgatho Health Sciences University. A random sample of 176 (123 females and 53 males) adult black subjects, diagnosed with and treated for T2DM at the outpatients diabetic clinic of DGMAH was investigated in the current study. Only patients who gave their informed consent were included in the study. The study was conducted in accordance with the requirements of the research and ethics committee of the University of Limpopo (MREC/M/08/2012:PG).

Data collection

All study participants were requested to fast for a minimum of 8 hours before coming to hospital for their next clinical assessment appointment. On their arrival at the diabetic clinic venous blood samples were collected from all participants into specific blood collection tubes (BD Vacutainer®, Franklin Lakes, NJ, USA) for the measurement of HbA1c, FBG and serum lipid profile components. All biochemical variables were measured in the National Health Laboratory Services (NHLS) laboratory at the DGMAH using automated standard procedures for these variables. Demographic data, socioeconomic data, information regarding current diabetic medication, duration of diabetes as well as the presence or absence of co-morbid medical conditions were collected from the medical records of the study subjects using a structured questionnaire, specifically designed for the purpose of the study. Blood pressure measurements were taken in the seated position with the patient's elbow flexed at the heart level, after the subject had rested for about five minutes using a standard mercury sphygmomanometer.

Anthropometric measures of obesity including body mass index (BMI), waist circumference (WC) and waist-to- hip ratio (WHR) were also performed using standard procedures for these measurements. Because the study subjects already had glucose intolerance due to TD2M, the presence of metabolic syndrome (MetS) in the study subjects was assessed according to both the modified International Diabetic Federation (IDF) criteria with European WC cut-off points (IDF (Europe))[18] and IDF criteria with proposed African cut-off points (IDF (Africa)).[19] According to these modified criteria, the diagnosis of MetS in diabetic patients was based on the presence of abdominal obesity (WC > 94 cm in men and > 80 cm in women (IDF (Europe)[18] or WC > 94 cm for both men and women (IDF (Africa)[19] plus one or more of: high fasting glucose (≥ 5.6 mmol/l) or previously diagnosed type 2 diabetes, hypertriglyceridemia (≥1.7 mmol/l) or treatment for elevated triglycerides, low HDL-cholesterol (< 1.04 mmol/l in men and < 1.29 mmol/l in women) or treatment for low HDL, high blood pressure (≥ 130 mmHg SBP or ≥ 85mmHg DBP)

Statistical analysis

In this study categorical data are expressed as numbers and percentages and continuous data are expressed as mean ± standard deviation. Differences between groups were determined using the chi-square test (categorical data) and either Student's t-test or analysis of variance for continuous data). Differences between groups were regarded to be significant for *p*-values less than 0.05. Bivariate logistic regression analysis was conducted to identify factors determinant of poor glycaemic control at DGMAH and multivariate logistic analysis was performed to identify independent predictors of glycaemic control at DGMAH. For the purpose of this study, variables identified with a *p*-value of less than 0.05 by univariate analysis were used for multivariate analysis. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) software version 24 (IBM Corp, Armonk, NY, USA).

Results

Demographic, socioeconomic and clinical characteristics of the study subjects

The current study investigated a total of 176 patients (53 men and 123 women) with T2DM aged between 35 and 74 years, with a mean age of 58.95 (± 11.5) years. The demographic, selected socioeconomic and selected clinical characteristics of the study subjects are summarised in Table 1. Significant differences between male and female study subjects with regard to socioeconomic variables were observed only for the single marital status and some occupation status. In this regard, there were significantly more single women than men ($p = 0.039$) and, compared with men, most women were domestic workers ($p = 0.043$). Also, compared with women, most men were pensioners ($p = 0.002$). Also shown in Table 1, the duration of diabetes was more than 5 years in 63.1% of the study subjects with a significant difference between male and female study subjects ($p = 0.025$). More than half of the study subjects (52.2%) were treated with a combination of metformin and insulin (actraphane) at the time of data collection. However, there were no significant differences in the modality of treatment between male and female study subjects.

Glycaemic control

Measures of glycaemic control and the different categories of levels of poor glycaemic control among the study subjects are given in Table 2. In both male and female study subjects, mean FPG and mean HbA1c levels were significantly higher among the study subjects relative to the SEMDSA (2012) recommended target values of 6.1 mmol and 7.0% respectively. Only 16.6% of the study subjects (16.9% males and 16.4% females) were optimally controlled and achieved the SEMDSA (2012) recommended target HbA1c value of 7.0% or less.

Among the study subjects who were suboptimally controlled, 29.5% and 53.8% of the study subjects were borderline (HbA1c levels between 7.0 and 8.9%) and poorly controlled (HbA1c > 9.0%) respectively. There were, however, no significant differences in measures of glycaemic control between male and female study subjects.

Metabolic syndrome and its components

The percentage frequencies of metabolic syndrome (MetS) and that of its components are listed in Table 3. The frequency of MetS as defined by both the IDF (Europe) and IDF (Africa) was very high among the study subjects. It was found to be 90.1% according to the IDF (Europe) criteria and 86.7% according to the IDF (Africa) criteria. There were, however, no significant differences in MetS frequencies between male and female study subjects (Table 3). The most common component of MetS among the study subject was central obesity (WC > 94 cm (males) and > 80 cm (females) in 95.4%, followed by hypertension (87.6%), low HDL-C (85.4%) and general body obesity (BMI > 30 kg/m^2)

Table 1: Demographic, selected socioeconomic and selected clinical characteristics of the study subjects stratified by gender

Characteristics	Male ($n = 53$)	Female ($n = 123$)	p-value	Total subjects ($n = 176$)
Age: mean (SD)	63.2 ± 9.8	54.7 ± 12.1	0.065	58.95 ± 11.5
Family history of diabetes:				
Yes: *n* (%)	34 (64.2)	71 (57.7)	0.081	105 (59.7)
No: *n* (%)	19 (35.8)	52 (42.3)	0.079	71 (40.3)
Marital status:				
Married: *n* (%)	38 (71.7)	78 (63.4)	0.053	116 (65.9)
Single: *n* (%)	2 (3.8)	24 (19.5)	0.039*	26 (14.8)
Widowed/divorced: *n* (%)	13 (24.5)	21 (17.1)	0.641	34 (19.3)
Occupation:				
Domestic worker: *n* (%)	8 (15.1)	36 (29.3)	0.043*	44 (25.0)
Pensioner: *n* (%)	22 (41.5)	27 (21.9)	0.002*	49 (27.8)
Professional: *n* (%)	11 (20.8)	36 (29.3)	0.071	47 (26.7)
Other: *n* (%)	12 (22.6	24 (19.5)	0.174	36 (20.5)
Level of education:				
Higher: *n* (%)	12 (22.6)	29 (23.6)	0.233	41 (23.3)
Secondary: *n* (%)	20 (37.1)	41 (33.3)	0.153	71 (40.3)
Primary: *n* (%)	18 (33.9)	44 (35.8)	0.412	52 (29.6)
Illiterate: *n* (%)	3 (5.16)	9 (7.3)	0.303	12 (6.8)
Duration of diabetes:				
< 5 years: *n* (%)	17 (32.1)	48 (39.0)	0.111	65 (36.9)
> 5 years: *n* (%)	36 (67.9)	75 (84.0)	0.025*	111 (63.1)
Medication at the time of the study:				
OAA alone: [*n*; %]	17 (32.1)	27 (22.2)	0.062	44 (25.0)
Protaphane + metformin: [*n*; %]	9 (17.0)	31 (25.0)	0.053	40 (22.7)
Actraphane + metformin: [*n*; %]	27 (50.9)	65 (52.8)	0.892	92 (52.3)

SD: standard deviation.
* Significant differences at $p < 0.05$.

(61.3%). The least common component of MetS among the study subjects was hypertriglyceridemia (39.1%).

Significant differences in terms of overweight and morbid obesity between male and female study subjects were observed in the current study (see Table 3). Male study subjects were significantly overweight (BMI, 25–30 kg/m^2) compared with female study subjects ($p = 0.018$), whereas females were significantly more morbidly obese (BMI > 40 kg/m^2) than their male counterparts ($p = 0.002$) (see Table 3).

A significant difference between male and female study subjects was also observed for hypertriglyceridemia ($p = 0.021$). There were, however, no significant differences between male and female study subjects with regard to the frequencies of MetS (both IDF (Europe) and IDF (Africa) criteria), WC, WHR, hypertension and low HDL-cholesterol levels.

Bivariate logistic regression analysis of factors known to influence glycaemic control

In order to determine the association between factors that are known to affect glycaemic and poor glycaemic control among the study subjects, the subjects were divided into two groups (adequately glycaemic controlled group, $n = 27$ and poorly glycaemic controlled group, $n = 149$) and the odds ratio calculated for each risk factor using bivariate logistic regression analysis. Associations between selected patient-related, disease-related, socioeconomic factors and treatment-related factors and poor glycaemic control (HbA1c > 7.0%) in terms of crude odd ratios (COR) and their 95% confidence intervals (CI) and p-values in the study subjects are summarised in Table 4.

Bivariate logistic regression analysis of factors known to influence glycaemic control showed that diabetes was more likely to be poorly controlled among patients who are married (COR = 3.84; 95% CI: 1.42–10.3; $p = 0.005$); those whose highest education level > Grade 12 (COR = 4.28; 95% CI: 1.05–10.8; $p = 0.003$); those with duration of diabetes longer than five years (COR = 2.45; 95% CI: 1.05–5.72; $p = 0.034$); those with waist circumference > 94 cm (M) and > 80 cm (F) (COR = 3.79; 95% CI: 1.52–9.4; $p = 0.0054$) and those with increased waist-to-hip ratio > 0.95 for males and > 0.85 for females (COR = 4.06; 95% CI: 1.50–10.9; $p = 0.008$) compared respectively with those who are not married (single), whose education level is < Grade 12; those with duration of diabetes < five years; those with WC < 94 cm (M) and 80 cm (F) and those with WHR < 0.95 (M) and 0.85 (F). Other factors such as age, gender, family history of diabetes, marital status, occupation, body mass index, blood pressure, dyslipidaemia and the presence of metabolic syndrome were not significantly associated with poor glycaemic control at DGMAH.

Multivariate logistic analysis was performed to identify independent predictors of glycaemic control among the study subjects. For the purpose of this analysis, determinants that were significantly associated with suboptimal glycaemic control ($p < 0.05$) in bivariate logistic regression analysis (marital status, level of education, duration of diabetes and waist circumference) were subjected to multivariate logistic regression analysis using the SPSS statistical package. The results of this multiple logistic analysis are summarised in Table 5.

Table 2: Glycaemic control status of the study subjects stratified by gender

Characteristic	Male ($n = 53$)	Female ($n = 123$)	p-value	Total ($n = 176$)
FBG: mean ± SD (mmol/l)	10.3 ± 1.7	11.4 ± 2.34	0.167	10.85 ± 2.05
HbA1c: mean ± SD (%)	9.72 ± 1.5	9.40 ± 3.8	0.814	9.56 ± 2.65
Optimal controlled (HbA1c ≤ 7.0%)				
[*n*; %]	9 (16.9)	18 (16.4)	0.231	27 (16.6)
Sub-optimally controlled:				
Borderline (HbA1c, 7.0–8.9%)	18 (33.9)	49 (39.8)	0.401	67 (29.5)
Poor (HbA1c ≥ 9.0%)	26 (49.1)	56 (45.5)	0.302	82 (53.8)
Total	44 (83.1)	105 (83.6)	0.645	149 (83.3)

FBG: fasting blood glucose; HbA1c: haemoglobin-A1c.

Discussion

Demographic and clinical characteristics of the study subjects

The prevalence of T2DM is reported to be higher in men than women; however, there are more women than men with diabetes.[20] In agreement with this notion, the randomly selected study sample for the current study consisted of 123 females and 53 males. The observation that 59.9% of the study subjects had a family history of diabetes suggests some genetic predisposition for the development of T2DM in the study subjects. With regard to the marital status of the study subjects, there were significantly more single women than men ($p = 0.039$) in the current study. This observation has never been reported before and its implication is unknown. Thus, more studies are needed either to confirm and/or to explain the observation.

Other significant observations in the current study were the observations that (1) compared with men, a significant proportion of women were domestic workers ($p = 0.043$) and (2) there were more female pensioners than male pensioners in the current study. The observation that there were significantly more domestic workers among women than men is in line with the observation that women were significantly more morbidly obese ($p = 0.002$) than men in the current study. Both observations suggest that female study subjects were less active than males, a factor that might have contributed to their predisposition to develop T2DM. The observation in the current study that there were more female pensioners than male pensioners appears to be rather strange and unexpected in light of the facts that (1) the average age of men (63.2 ± 9.8) was more than the average for women (54.7 ± 12.1) and (2) in South Africa both men and women become eligible for their pension at 60 years of age. The duration of diabetes was more than five years in 63.1% of the study subjects with a significant difference between male and female study subjects ($p = 0.025$). This observation needs to be interpreted with caution, as the date of initial diagnosis of T2DM was not recorded in most patient files and during interviews most patients might not have given an accurate recall as to when they were diagnosed with T2DM. The best they could provide was an estimation of the date of their first diagnosis. The observation that more than half of the study subjects (52.2%) were treated with a combination of metformin and insulin (actraphane) at the time of data collection suggests that, in most study subjects, T2DM had advanced to a stage where it could not be managed by oral hypoglycaemic agents alone.

Glycaemic control

Overall, the proportion of study subjects with poor glycaemic control was very high in the current study. Only 16.6% of the study subjects (16.9% males and 16.4% females) were optimally controlled and achieved the SEMSDA (2012) recommended target of HbA1c level of less than 7.0%. This observation is in agreement with the results of other South African studies that have investigated and reported on the status of glycaemic control among T2DM patients.[6–8] Thus, the results of the current study confirm the fact that, as is the case all over the

Table 3: Percentage frequencies of metabolic syndrome and its components among the study subjects stratified by gender

Components of MetS	Males $n = 53$	Females $n = 123$	P-value	Total $n = 176$
Body mass index (kg/m^2), *n* (%):				
< 25	8 (15.1)	12 (9.8)	0.078	20 (11.4)
25–30	21 (39.6)	33 (26.8)	0.018*	54 (30.7)
31–40	24 (45.3)	64 (52.0)	0.086	88 (50.0)
> 40 (morbid obesity)	0 (0)	14 (11.4)	0.002*	14 (7.9)
Central obesity, *n* (%):				
WC [> 94 cm (M); and > 88 cm (F)]	51 (96.2)	117 (95.1)	0.347	198 (95.4)
WHR [> 0.90 cm (M); and > 0.85 cm (F)]	30 (56.6)	72 (58.5)	0.061	92 (52.3)
Blood pressure (> 130/85) mmHg	27 (51.8)	81 (65.9)	0.201	108 (57.6)
Hyperglyceridaemia (≥1.7 mmol/l)	6 (11.3)	42 (34.1)	0.021*	48 (39.1)
Low HDL-C [≤ 1.03 mmol/l (M) and ≤ 1.29 mmol/l (F)]	30 (56.6)	75 (60.9)	0.854	105 (85.4)
Presence of MetS:				
None	2 (3.7)	2 (1.6)	0.765	4 (2.2)
IDF (Europe)	47 (88.7)	113 (91.8)	0.688	160 (90.9)
IDF (Africa)	47 (89.2)	105 (85.4)	0.765	152 (86.4)

Table 4: Bivariate logistic regression analysis of the association between known determinants of poor glycaemic control and poor glycaemic control at DGMAH

Factor: *n* (%)	Optimally glycaemic controlled (HbA1c < 7) (*n* = 27)	Poorly glycaemic controlled (HbA1c ≥ 7) (*n* = 149)	COR (95% CI)	*p*-value
Age of study subjects:				
< 50	12 (44.4%)	79 (53.0%)	1.0 ref.	
> 50	15 (55.6%)	70 (47.0%)	1.41 (0.62–3.21)	0.413
Gender:				
Female	15 (55.6%)	84 (56.4%)	1.0 ref.	0.920
Male	12 (44.4%)	65 (43.6%)	1.03 (1.45–2.85)	
Family history:				
No	13 (48.2%)	75 (50.3%)	1.0 ref.	
Yes	14 (51.8%)	74 (51.8%)	1.06 (0.48–2.47)	0.841
Marital status:				
Single	6 (20.7%)	68 (45.6%)	1.0 ref	
Married	18 (67.9%)	53 (35.8%)	3.84 (1.42–10.3)	0.005
Widowed/divorced	3 (11.3%)	28 (18.8%)	1.21 (0.28–5.19)	0.529
Occupation:				
Unemployed	4 (14.8%)	16 (10.7%)	1.0 ref.	
Domestic worker	8 (29.6%)	48 (32.2%)	0.67 (0.17–2.51)	0.389
Professional	5 (18.6%)	45 (30.2%)	0.44 (0.11–1.86)	0.225
Pensioners	8 (29.6%)	31 (20.8%)	1.05 (0.29–3.85)	0.608
Level of education:				
Lower than Grade 12	17 (63.0%)	131 (88.0%)	1.0 ref.	
Grade 12 and above	10 (37.0%)	18 (12.0%)	4.28 (1.70–10.7)	0.003
Duration of disease:				
< 5 years	10 (37.1%)	88 (59.0%)	1.0 ref.	
> 5 years	17 (59.0%)	61 (41.0%)	2.45 (1.05–5.72)	0.034
BMI (kg/m^2):				
< 25	5 (18.5%)	41 (27.5%)	1.0 ref.	
25–30	17 (62.9%)	56 (37.6%)	2.48 (0.84–7.29)	0.145
> 30	5 (18.5%)	52 (34.9%)	0.78 (0.21–2.91)	0.486
Waist circumference:				
< 94cm (M) and < 88cm (F)	10 (37.0%)	20 (13.3%)	1.0 ref.	
> 94cm (M) and > 88cm (F)	17 (63.0%)	129 (86.7%)	3.79 (1.52–9.44)	0.005
Waist-to-hip ratio:				
≤ 0.95 (M) and ≤ 0.85 (F)	19 (70.4%)	135 (90.8%)	1.0 ref.	
> 0.95 (M) and > 0.85 (F)	8 (29.6%)	14 (9.20%)	4.06 (1.50–10.9)	0.008
Presence of MetS:				
None	7 (25.9%)	60 (40.2%)	1.0 ref.	
IDF (Europe)	11 (40.7%)	50 (33.5%)	1.88 (0.68–5.22)	0.217
IDF (Africa)	9 (33.3%)	39 (26.1%)	1.87 (0.68–5.74)	0.204
Current medication:				
OAA only	14 (51.8)	95 (63.8)	1.0 ref.	
Metformin + insulin	13 (48.2)	54 (36.2)	1.63 (0.22–3.11)	0.502

COR: crude odds ratio; M: males; BMI: body mass index;
CI: confidence interval; F: females; IDF: International Diabetic Federation;
OAA: oral anti-diabetic agents; MetS: metabolic syndrome. * = Significance at $p < 0.05$.

world, achieving sustained good glycaemic control is a challenge among South African T2DM patients.

Metabolic syndrome and its components

The prevalence of both general and central obesity was found to be very high among the study subjects, with female study subjects being significantly more morbidly obese than their male counterparts. There was, however, no significant difference in either WC or WHR among male and female study subjects. The high prevalence of both general and central obesity observed in the current study could be attributed to several factors including lack of physical activity, unhealthy diets and insulin resistance. The prevalence of hypertension among the T2DM study subjects was very high in the current study while that of diabetic dyslipidaemia was very low (13.6%). These observations could probably be related to the ineffectiveness of the anti-hypertensive medications and effectiveness of the management of diabetic dyslipidaemia at DGMAH.

In the current study, the presence of MetS in T2DM study subjects was determined using both the IDF (Europe) and IDF (Africa) criteria. The difference between these two criteria is

Table 5: SPSS multivariate logistic regression output (variables in the equation) of factors associated with poor glycaemic control at DGMAH

Factor	B	S.E.	Wald	df	Sig.	Ex (B)	95% CI for Ex (B)	
							Lower	Upper
Step 1[a] Marital status	0.006	0.022	0.65	1	0.799	1.006	.962	1.051
Level of education	0.014	0.15	0.883	1	0.347	1.014	.985	1.045
DOD	0.005	0.753	0.460	1	0.497	1.011	1.37	2.624
WC	0.085	0.028	9.132	1	0.003	1.089	1.030	1.151
Constant	1.676	3.336	0.253	1	0.615	.187		

[a] Variables entered in step 1: marital status, education level, duration of diabetes (DOD) and waist circumference (WC).

the cut-off points for WC in both male and female subjects.[19] Also, since all the study subjects were diabetic and thereby glucose intolerant, only two additional components (instead of the usual three components of MetS) were used to diagnose MetS in the current study. The frequency of MetS as defined by both IDF (Europe) and IDF (Africa) was very high among the study subjects. This high prevalence of MetS in the study subjects is probably related to obesity-induced insulin resistance in the study subjects. This hypothesis is supported by the findings that both WC and WHR were significantly associated with poor glycaemic control in both bivariate and multivariate logistic regression analysis of the factors known to be associated with poor glycaemic control. In the current study, the prevalence of diabetic dyslipidaemia was very low (13.6%) and LDL-C and TC were not elevated in most study subjects. These findings could be attributed to the effectiveness of management of diabetic dyslipidaemia at DGMAH.

Limitations and recommendations from the study

The findings of the current study might have been influenced by several limitations. First, the sample size was small, thereby making it difficult to generalise the findings. Second, the study was a cross-sectional study and therefore a cause-and-effect relationship could not be inferred from the study results. Third, patients were recruited from a single institute rather than being a community-based sample. Thus the findings could not be generalised beyond this study sample. However, despite these limitations, the current study offers insight into the status of glycaemic control and some of its major determinants at DGMAH.

Conclusions

The results of the current study suggest that glycaemic control in T2DM is very poor at DGMAH and that it may be negatively influenced by longer duration of the disease, increased WC and/or increased WHR. Since both WC and WHR are modifiable factors, an educational programme that emphasises lifestyle modification may be beneficial to T2DM patients at DGMAH. The observation that glycaemic control is very poor at DGMAH suggests that T2DM patients at this hospital are likely to develop irreversible microvascular and macrovascular complications of diabetes mellitus. Thus, the results of this study may go a long way to increase awareness of the need to aggressively and timeously prevent the development of these complications.

Disclosure statement – No potential conflict of interest was reported by the authors.

References

1. UKPDS. Intensive blood-glucose control with sulphonylureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes (UKPDS 33). Lancet. 1998;352:837–853.
2. ACCORD Study Group, ACCORD Eye Study Group, Chew EY, et al. Effects of medical therapies on retinopathy progression in type 2 diabetes. N Engl J Med. 2010;363:233–244.
3. ADVANCE, Collaborative Group, Patel A, MacMahon S, et al. Intensive blood glucose control and vascular outcomes in patients with type 2 diabetes. N Engl J Med. 2008;358:2560.
4. Safarini S, Hilali HH, Elsheikh S, et al. Analytic study of 594 type 2 diabetic patients attending a private diabetes and endocrine center at dallah hospital in Riyadh, KSA. J Diabetes Metab. 2012;3:10–21.
5. Mendes AB, Fittipaldi JA, Neves RC, et al. Prevalence and correlates of inadequate glycaemic control: results from a nationwide survey in 6,671 adults with diabetes in Brazil. Acta Diabetol. 2010;47(2):137–145.
6. Erasmus RT, Blanco Blano E, Okesina AB, et al. Assessment of glycaemic control in stable type 2 black South African diabetics attending a peri-urban clinic. Postgrad Med J. 1999;75(888):603–606.
7. Rotchford AP, Rotchford KM. Diabetes in rural South Africa – an assessment of care and complications. S Afr Med J. 2002;92(7):536–541.
8. Klisiewicz AM, Raal F. Sub-optimal management of type 2 diabetes mellitus – a local audit. JEMDSA. 2009;14(1):13–16.
9. SEMDSA. The 2012 SEMSDA guideline for the management of type 2 diabetes. JEMSDA. 2012;17(2):S1–95.
10. Al-Akour NA, Khader YS, Alaoui AM. Glycemic control and its determinants among patients with type 2 diabetes mellitus attending a teaching hospital. J Diabetes Metab. 2011;2:129.
11. Khattab M, Khader YS, Al-Khawaldehd A, et al. Factors associated with poor glycemic control among patients with type 2 diabetes. J Diabetes Complicat. 2010;24:84–89.
12. Woldu MA, Wami CD, Lenjisa JL, et al. Factors associated with poor glycemic control among patients with type 2 diabetes mellitus in Ambo Hospital, Ambo; Ethiopia. Endocrinol Metab Synd. 2014;3:143.
13. Ghazanfari Z, Niknami S, Ghofranipour F, et al. Determinants of glycemic control in female diabetic patients: a study from Iran. Lipids Health Dis. 2010;9:83.
14. Juarez DT, Sentell T, Tokumaru S, et al. Factors associated with poor glycemic control or wide glycemic variability among diabetes patients in Hawaii, 2006–2009. Prev Chronic Dis. 2012;9:120065.
15. Sanghani NB, Parchwani DN, Palandurkar KM, et al. Impact of lifestyle modification on glycemic control in patients with type 2 diabetes mellitus. Indian J Endocr Metab. 2013;17:1030–1039.
16. Ramirez LDH, Soto AF, Valenzuela CLC, et al. Factors influencing glycemic control in patients with diabetes type II in Mexican patients. J Fam Med. 2016;3(2):1051.
17. Kamuhabwa AR, Charles E. Predictors of poor glycemic control in type 2 diabetic patients attending public hospitals in Dar es Salaam. Drug Healthc Patient Saf. 2014;6:155–165.
18. Alberti KG, Zimmet P, Shaw J. Metabolic syndrome-a new world-wide defi nition. A consensus statement from the international diabetes federation. Diabet Med. 2006 May;23(5):469–480.
19. Longo-Mbenza B, Kasiam JB, Lasi On'kin A, et al. Metabolic syndrome, aging, physical inactivity, and incidence of type 2 diabetes in general African population. Diab Vasc Dis Res. 2010;7:28–39.
20. Wild S, Roglic G, Green A, et al. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diab Care. 2004;27(5):1047–1053.

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