Diabetes & Metabolic Syndrome: Clinical Research & Reviews xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Diabetes & Metabolic Syndrome: Clinical Research & Reviews

journal homepage: www.elsevier.com/locate/dsx

Original Article

Glycaemic control in Sudanese individuals with type 2 diabetes: Population based study

Sufian K. Noor[a], Wadie M. Elmadhoun[b], Sarra O. Bushara[a], Ahmed O. Almobarak[c], Reham S. Salim[d], Sittana A. Forawi[d], Heitham Awadallah[e], Einas S. Elwali[d], Mohamed H. Ahmed[f,*]

[a] Department of Medicine, Nile Valley University, Atbara, Sudan
[b] Department of Pathology, Nile Valley University, Atbara, Sudan
[c] Department of Pathology, Faculty of Medicine, University of Medical Sciences and Technology, Khartoum, Sudan
[d] Public and Tropical Health Program, University of Medical Sciences and Technology, Khartoum, Sudan
[e] Department of community medicine, Faculty of Medicine, University of Khartoum, Khartoum, Sudan
[f] Department of Medicine, Milton Keynes University Hospital NHS Foundation Trust, Eaglestone, Milton Keynes, Buckinghamshire, UK

ARTICLE INFO

Article history:
Available online xxx

Keywords:
River Nile State
Khartoum
Sudan
Diabetes
Dyslipidemia

ABSTRACT

Background: Diabetes mellitus (DM) is a major health problem in Sudan and is a leading cause of morbidity and mortality. The objective of this study was to determine the prevalence of glycaemic control among individuals with type 2 diabetes across different cities in Sudan.
Methods: Individuals with type 2 diabetes attending selected diabetes centres in Sudan, who had been on treatment for DM for at least one year and volunteered to participate were included. Participants were interviewed using standardized pretested questionnaire to record medical history, sociodemographic and life style characteristics. Lipid profile and glycosylated hemoglobin were tested by calibrated laboratory methods. Blood pressure, Body mass index (BMI) and waist circumference were measured. Chi squared and logistic regression were used as statistical methods.
Results: A total of 387 individuals with T2DM were included in this study (50.4% males and 49.6% females). The glycemic control indicator (HbAIc>7) was poor in 85% of patients. Factors associated with poor glycemic control were prolonged duration of diabetes ($p = 0.03$), high plasma triglyceride ($p = 0.02$), low high density lipoprotein (HDL) level ($p = 0.04$) and low glomerular filtration rate (GFR) ($P = 0.01$). Logistic regression analysis showed that low GFR is independent factor with poor diabetes control.
Conclusion: High prevalence of uncontrolled diabetes (85%) is noted in Sudanese individuals with type 2 diabetes.

1. Introduction

The estimated global prevalence of diabetes mellitus (DM) is around 8.3% and represents a challenge to health authorities across the globe [1,2]. The prevalence of DM in the Middle East and North Africa (MENA) was estimated to be around 25%. More alarming, is the fact that the number of individuals affected by DM in Africa will increase from 14 million currently to 28 million by the year 2030 [3–6].

The prevalence of diabetes in urban areas in north Sudan is 19% [7]. Furthermore, the prevalence of diabetes among the Danagla tribe living in the North of Sudan was 8.3% [8]. The prevalence of undiagnosed diabetes in rural communities of north Sudan was 2.6% and the prevalence of impaired glucose tolerance was 1.6% [9]. Obesity is a recognized cause of insulin resistance as well as Non-alcoholic fatty liver (NAFLD). For instance, the prevalence of NAFLD among Sudanese individual was estimated to be around 20%, while the prevalence of NAFLD among Sudanese individuals with type 2 diabetes was estimated to be 50% [10,11]. One of the serious challenges for health authorities in Sudan will be how to provide adequate treatment for individuals with diabetes in order to provide best glycaemic control. The prevalence of uncontrolled diabetes is an important issue for low income, middle and high income countries. For Example, in six African countries the avearage of good glycaemic control was noted in only 29% [12]. In Ethiopia, the prevalence of poor diabetes was between 64.7% and 82%, [13,14] in Tanzania was 69.7%, in South Africa between 67%–83% and in Zambia was 61.3% [15–17]. Rich countries like China and

* Corresponding author.
E-mail address: elziber@yahoo.com (M.H. Ahmed).

http://dx.doi.org/10.1016/j.dsx.[56_TD$DIFF]2016.12.024
1871-4021/

Japan are also struggling to achieve good diabetes control. For instance, in Japan the prevalence of good diabetes control was 44.9% and in China good diabetes control was achieved in 41% of those in insulin therapy and 35.9% on oral antidiabetic medications [18,19].

In order for health authorities in Sudan to provide sustainable diabetes service, it is important to determine how appropriate are the indicators of diabetes control. Therefore, the aim of this study was to determine prevalence of glycemic control and risk factors in Sudanese individuals with type 2 diabetes.

2. Material and methods

2.1. Study design

This was a descriptive, cross sectional, hospital-based study.

2.2. Setting and population

Individuals with diabetes who attended diabetes centers in Atbara, River Nile State and Khartoum were included in this study. Inclusion criteria included adults over 18 years who were diagnosed as T2DM and being on diabetic treatment for at least one year.

2.3. Data collection tools

A validated, pre-tested, interviewer-administered questionnaire was used to obtain demographic data, diabetes related enquiries in addition to physical measurements including anthropometric measurements and biochemical tests.

2.4. Laboratory methods

Fasting levels of plasma glucose, cholesterol, triglycerides, high density lipoprotein (HDL), low density lipoprotein (LDL) and glycosylated hemoglobin (HbA1c) were measured using standardized laboratory techniques.

2.5. Anthropometric measurements

Anthropometric measurements were taken using standardized and calibrated equipments, body mass index (BMI) was calculated using the formula: weight in kilogram divided by height per squired meter. BMI was classified according National Institute of Health(NIH) of USA as follows: BMI less 18.5 is under weight, between 18.5 and 24.9 is normal, between 25 and 29.9 is overweight, 30 to 34.9 is Class1 obesity, from 35 to 39.9 is Class 2 obesity and BMI of 40 or more is class 3 or morbid obesity [20].

2.6. Waist circumference

Waist circumference was measured by a tape measure at the level of the umbilicus. A waist circumference of 94 cm or more in males and 80 cm or more in females defines central obesity [20].

3. Ethical clearance

A written consent was obtained from all participants prior to enrolment. The following information was given during data collection, to insure that participants had the information to make the informed consent. That participation was optional. There should be no penalty for refusal. A complete description of the aims of the study, potential benefits and risks, and assurance of confidentiality of any information given, any other additional information requested by participants was provided during data collection. A formal ethical approval was obtained from the ethical committee of the Faculty of Medicine – Nile Valley University and University of Medical Sciences and Technology in Khartoum.

4. Statistical analysis

The collected data was analyzed by computer using Statistical Package for Social Sciences (SPSS) version 21. The fequencies, mean and standard deviation was calculated. Pearson Chi square test was used to compare between proportions. The level of significance was considered if P value was less than 0.05. T test was also used and logistic regression analysis was used to establish association of risk factors with poor diabetes control.

Table 1
The significance between the various socio-demographic characteristics and clinical factors to the status of glycemic control among Sudanese individuals with type 2 DM, (n = 387).

Variable	HbA1cLevel		Total	p.value
	Controlled <7%	Uncontrolled>7%		
gender				
male	22	173	195	0.03
	11%	89%	100%	
female	37	155	192	
	24%	76%	100%	
Age				
20–30	1	4	5	0.24
	20%	80%	100%	
31–40	1	8	9	
	1%	99%	100%	
41–50	17	66	83	
	20%	80%	100%	
51–60	14	130	144	
	11%	89%	100%	
61–70	18	90	108	
	17%	83%	100%	
More than 70	8	30	38	
	21%	79%	100%	
Marital status				
married	48	260	308	0.98
	16%	84%	100%	
single	2	13	15	
	13%	87%	100%	
divorced	2	13	15	
	13%	87%	100%	
widow	7	42	49	
	14%	86%	100%	
Educational level				
illiterate	21	98	119	0.13
	18%	82%	100%	
basic school	13	87	100	
	13%	87%	100%	
secondary	20	83	103	
	19%	81%	100%	
college and above	5	60	65	
	8.00%	92%	100%	
Residence				
Urban	39	255	294	0.07
	13%	87%	100%	
Rural	20	73	93	
	22%	88%	24.00%	
Hypertension				
yes	24	127	151	0.78
	15.90%	84.10%	100.00%	
no	35	201	236	
	14.80%	85.20%	100.00%	

Personal and background characteristics and distribution according to glycemic control (HbA1c cut level is 7%): Only 59 (15%) individuals with type diabetes have HbA1c <7%), and statistical differences noted in female has better control (p.value 0.03).

Please cite this article in press as: S.K. Noor, et al., Glycaemic control in Sudanese individuals with type 2 diabetes: Population based study, Diab Met Syndr: Clin Res Rev (2016), http://dx.doi.org/10.1016/j.dsx.2016.12.024