

## A study of the adherence to some American Diabetes Association targets among diabetic patients attending an outpatient endocrine clinic in Omdurman Teaching Hospital in Sudan

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### Abstract

**Background&Aim:** Diabetes mellitus is a major health problem that leads to macrovascular and microvascular complications, evidence-based guidelines are proposed to prevent and delay these complications, but these goals are not usually met. In the current study, we aimed to investigate some American Diabetes Associations targets and vascular risk factors among patients with type 2 diabetes mellitus.

**Materials & Methods:** A prospective cross-sectional study was conducted among 400 adult diabetic patients, seen in the endocrine clinic of Omdurman Teaching Hospital, Sudan, in the period, March 2013-September 2013. Participants were interviewed using a structured questionnaire to collect demographic data, five ADA targets, Body mass index, waist circumference, and physical activity. The local ethical committee approved the research, and the Statistical Package for Social Sciences (SPSS) was used for data analysis.

**Results:** Of the 400 patient, 242 were women (63%). The age range was 23-88 years. With a mean of 57.7±14 years. The average duration of the disease was 13.6± five years. 98% of women and 91.5 % of men showed central adiposity, 41.5% of them were overweight 21.5% were males and 20% were females, only (26.5%) met the ADA target for HbA1c, (24.5%) for LDL, (11%) for HDL, (75%) for triglycerides, (65%) had met blood pressure targets, and (12%) were on lipid-lowering drugs.

**Conclusion:** The study indicates suboptimal fulfillment of some ADA goals. And the prominence of some unwanted vascular risk factors, An effort by government community to establish a good diabetes care is highly needed.

**Keywords:** Adherence, ADA, Targets, Sudan.

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### 1-Introduction

Diabetes mellitus is a global burden nowadays. It is increasing at alarming rates not only in the developed world but also in developing countries as well. It is estimated that by the year 2030 the number will reach 250-300 million patients. Diabetes mellitus is a lifetime disease that represents a major health problem. It imposes both financial and emotional load not only on the patient himself but also on his family and the community as a whole <sup>(1)</sup>. Diabetes mellitus is emerging as a significant health problem in Sudan due to recent changes in the lifestyle of the population with a lack of exercise and consumption of unhealthy diets that contain high saturated fats and refined sugars. According to World Health Organization (WHO) report, the number of diabetic patients in Sudan will increase from approximately half million patients in the year 2000 to more than one million by the year 2030<sup>(2)</sup>. In the year 1997, the Expert Committee on Diagnosis and Classification of Diabetes Mellitus defined patients with impaired fasting glucose (IFG) or impaired glucose tolerance (IGT) as having blood glucose levels higher than normal but cannot be considered as diabetics because they do not meet the criteria for definitive diagnosis<sup>(3)</sup>. These patients are referred to as prediabetics, indicating their high risk of developing

overt diabetes mellitus in the future. Prediabetes is associated with obesity (especially abdominal or visceral obesity), dyslipidemia with high triglycerides and low HDL cholesterol, and hypertension<sup>(4)</sup>. Previous studies showed that subjects whose hemoglobin A1C (HbA1C) levels between 5.5 and 6.0% had a substantially increased risk of diabetes with 5-year incidence rates ranging from 9-25%<sup>(6)</sup>. Those with HbA1C range of 6.0-6.5% had a 5-year risk of developing diabetes between 25-50% and relative risk 20 times higher than those with HbA1C of 5.0%<sup>(5)</sup>.

Low-density lipoprotein consists of a heterogeneous spectrum of particles with highly variable atherogenic potential<sup>(6)</sup>, and high level of these particles is a major risk factor for coronary artery disease.<sup>(7)</sup>

Diabetes management should include, in addition to pharmacological therapy, particular focus on exercise, diet, weight reduction and cessation of smoking. Optimal control of blood pressure and follow up of lipids are required in most cases. Follow-up with the eyes, feet, and renal functions are essential for early interventions<sup>(8)</sup>. The optimal glycemic control, and blood pressure and lipid management were shown to reduce microvascular complication by clinical trials, and possibly macrovascular complications<sup>(9)</sup>. To decrease mortality and morbidity from diabetes, evidence-based criteria have been proposed; the American Diabetes Association publishes annual guidelines. However, adherence to these guidelines is suboptimal<sup>(10,11)</sup>. To our knowledge, few researchers have studied the adherence to ADA targets for diabetes in Sudan. Thus we conducted this research to investigate the adherence to five ADA goals and vascular risk factors among patients with type 2 diabetes in Sudan.

## 2-Subjects and Methods

The study was conducted at the endocrine clinic in Omdurman Teaching Hospital in Sudan. We opted to include all diabetic patients (diagnosed according to The American Diabetes Association guidelines)<sup>(12)</sup> who had attended the clinic during the period from March 2013 to April 2014. A full explanation of the study was conveyed to them, and patients were assured that the information collected would be treated confidentially and for the purpose of the research only. The participants were informed that their participation is entirely voluntary, and they were assured that their follow-up would not be affected. All patients signed a written informed consent. Participants were then interviewed using a structured questionnaire to collect the following information: age, sex, duration of diabetes, body mass index, waist circumference, physical activity, and blood pressure. A blood sample was taken for fasting plasma glucose (after 8-10 hours overnight fast) using the hexokinase method<sup>(13)</sup> on Synchron CX9 auto analyzer the change in absorbance is measured at 340 nm, HbA1c using glycol hemoglobin reagent set from Pointe Scientific Inc.<sup>(14)</sup>, and lipid profile (12 hours overnight fast), the total cholesterol and triglycerides were measured using a colorimetric enzyme assay<sup>(15)</sup>. For the purpose of this study, we adopted the following normal values to assess the ADA targets cardiovascular risk factors:

- Fasting plasma sugar goal from 70-130 mg/dl.
- HbA1C % < 7.
- Low-density lipoprotein level < 100 mg/dl.
- Blood pressure < 130/80.
- Body mass index was calculated using the formula:  $\text{Weight in Kg}/(\text{height in meters})^2$
- Waist circumference < 88 cm for females and < 102 cm for males.
- Physical active patients are those who exercise daily for 20 minutes, 5 days per week.

**3-Results:**

A total number of participants were 400 diabetic patients, 63% of them were females. Their ages range from 23 to 88 years old with a mean age  $\pm$  SD of  $57.7 \pm 14$ . Near two-thirds of patients (65%) met ADA targets for blood pressure, more than half (54%) were obese and more than 90% of both males and females had central obesity (Table 1).Results of the biochemical analysis are shown in Table 2. Only minority of patients of had met the ADA targets: fasting blood sugar (39%), HbA1C  $\geq 7.0$  (26.5%), LDL (24.5%), HDL (48%) and triglycerides (75%).

**Table (1): Clinical characteristics of diabetic patients in the study group**

Character		Frequency
Gender	Men	148 (37%)
	Women	252 (63%)
Age (years)	Range	23 - 88
	Mean	57.7
Body mass index	Range	18-58
	Mean	31
Female waist circumference (cm)	Range	68 - 130
	Mean	100.7
Male waist circumference(cm)	Range	80- 145
	Mean	108.6
Blood pressure (mmHg)	<130/80	260(65%)
	$\geq$ 130/80	140 (35%)
Obesity	25 – 29.99	166 (41.5%)
	$\geq 30$	216 (54%)
Central obesity	Males	136(91.5%)
	Females	247 (98%)
Physical inactivity	Active	78 (19.5%)
	Inactive	322 (80.5%)

**Table (2): Results of biochemical analysis in the study group**

Parameter		No (%)	Range	Mean
Fasting blood sugar	< 130 mg/dl	152 (39%)	80 - 360	153.2
	≥130 mg/ dl	248 (61%)		
HbA1C	< 7 %	106(26.5%)	4.2% -15.6%	8.3%
	≥ 7 %	294(73.5%)		
LDL	≤ 100 mg/dl	98(24.5%)	45-276	123.6
	> 100 mg/dl	302(75.5%)		
HDL	≥ 40 mg/dl	192 (48%)	27- 66	42.1
	< 40 mg/dl	208(52%)		
Triglycerides	>150	100 (25%)	65 - 635	146.2
	≤150	300 (75%)		
On statin		48 (12%)		

**4-Discussion:** Chronic hyperglycemia in poorly controlled diabetes mellitus is a recognized cause of the vascular disease that affects both macro- and microvascular circulation. Common complications include coronary artery disease, peripheral arterial disease, and stroke as well as nephropathy, neuropathy, and retinopathy<sup>(16, 17)</sup>. In this study, only one-third of patients achieved the optimal target of fasting plasma sugar and about one quarter had HbA1C less than 7%. These findings indicate that the majority of patients had poorly controlled diabetes mellitus. Similarly, a longitudinal study of about nine years of follow-up, conducted by Robert and colleagues found that 42% of patients on insulin as monotherapy achieved FPG levels less than 7.8 mmol/L (140 mg/dL) and only 28% achieved HbA1c levels below 7%<sup>(18)</sup>.

In addition to the poorly controlled diabetes mellitus, more than half of our patients were obese, and the majority of the rest were overweight. These results are higher than the findings of Elansri and Ahmed study that found obesity in only 25.6% of diabetic patients and overweight in only 29.6% of them<sup>(19)</sup>. Central adiposity which is a recognized risk factor for cardiovascular disease is also higher in our patients compared to the previous study<sup>(19)</sup>. Our findings can be explained by the recent changes in dietary habits due to increased urbanization, with high consumption of refined sugar and fatty meals.

In the current study (80.5%) were physically inactive, in accordance with Elnasri and Ahmed<sup>(19)</sup> showed that 73.6% were physically inactive.

Regarding lipid profile in our study, 75.5% of our patients had elevated LDL levels in blood compared to findings in Nigeria where only 9.6% of diabetic patients had elevated LDL<sup>(20)</sup>. On the other hand, 52% of our patients had low HDL (<40mg/dl) which is comparable to results of other studies conducted in Nigeria<sup>(21)</sup>. However, the percentage of patients with high triglyceridemia is only 25% in contrast to diabetic patients in

Nigeria who showed a greater proportion of patients with hypertriglyceridaemia<sup>(20)</sup>. This can be partially explained by dietary, genetic factors in addition to the use of lipid-lowering drugs and metformin.

Blood pressure control is integral to diabetes treatment<sup>(22-25)</sup>. In the United Kingdom Prospective Diabetes Study (UKPDS), tight blood pressure control (average blood pressure 144/82 mmHg) reduced the risk of mortality by 32% in patients with newly diagnosed Type 2 diabetes compared to usual care (average blood pressure 154/87 mmHg)<sup>(26)</sup>. Benefits from tight blood pressure control are achieved if control is maintained for a considerable time<sup>(27, 29)</sup>. In our study, blood pressure appears to be controlled in about two-thirds of the patients. Similar findings were obtained in other studies<sup>(28)</sup>.

The current data were comparable to studies conducted in the United States of America<sup>(9)</sup> diabetes clinic, and the Kingdom of Saudi Arabia<sup>(30,31)</sup> regarding the HbA1c targets but lower than the USA Family and Internal Medicine Clinics, regarding LDL targets the present data were less than their US and Saudi counterparts in fulfilling the goals. The reason is multi-factorial, but the lesser use of statins in our sample is one plausible explanation (12% vs. 64.8-70.2%, and 72.3-92.4% in the US, and Saudi patients respectively).

**5-conclusion:** The study indicates suboptimal fulfillment of some ADA goals. And the prominence of some unwanted vascular risk factors. Implementations of obesity control measures through healthy diet and exercise programs are highly needed, physicians and those caring for diabetic patients need to adhere to the evidence-based guidelines to reduce the deleterious consequences of diabetes mellitus.

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