Knowledge, attitude and practice of Sudanese individuals with type 2 diabetes about medication used in treatment of diabetes, hypertension and dyslipidaemia: a matter of debate or matter of concern?

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Background: Diabetes is a chronic disease requires lifelong integrated treatment that includes lifestyle modifications and use of diabetes medication. The aim of this study was to establish knowledge, attitude and practice of Sudanese individuals with type 2 diabetes toward their medication.

Methods: This was a cross-sectional study that recruited 383 individuals with type 2 diabetes attend Jabir Abu Eliz Diabetes Canter. They aged between 18–65 years old. Individuals with type 2 diabetes are selected randomly and invited to complete the questionnaire, while Individuals with type1 diabetes, gestational diabetes and those aged less than 18 years old were excluded from this study.

Results: 76.5% of the interviewed patients had a valid health insurance, especially with 44% have diabetes for more than 10 years. Hypertension was one of the commonest co-morbidities (58%). Importantly 73% of the patients didn't purchase all their prescribed medications (medicine not available, no medical insurance and expensive medication). The common medication used in treatment of diabetes is metformin (46%). Glibenclamide accounted for (16%), glimepiride for (10%), glipizide for (0.3%) and pioglitazone for (1.3%). The most common antihypertensive medication used are angiotensin converting enzyme inhibitor (27%), angiotensin receptor blocker (24%) and calcium channel blocker (24%). 17% of the study population were receiving statins and 84% in low dose aspirin. Almost one third (31.7%) of interviewed patients were on insulin. Approximately 72% of these patients were using mixed insulin, 21% using soluble insulin and 3% used more than one type of insulin at the same time. Two-third of this population usually takes the insulin dose by themselves and (34%) of this group rotated injection site routinely in comparison with (66%) who stick to one site. In Sudan room temperature rarely drops to under 30 ℃ which necessitated refrigeration of insulin. Majority of the patients (81%) confirmed the storage of insulin vials in the refrigerator.

Conclusions: More than two third of Sudanese individuals did not bought all medications used in treatment of diabetes and co-morbidities. Metformin and sulfonylureas were widely used in treatment of diabetes. Hypertension is well treated but lipid lowering medication was used by almost less than one fifth of the individual with type 2 diabetes. Intensive education is needed to increase knowledge of individuals about diabetes in order to enhance attitude and practice. This education can be achieved in part by both community and clinical pharmacists.

Keywords: Diabetes; Sudan; knowledge; attitude; practice

Introduction

Diabetes is a chronic disease requires lifelong integrated treatment that includes lifestyle modifications, the use of anti-diabetics and other medications. The estimated global prevalence of diabetes is around 8.3% (1-3). Type 2 diabetes accounts for over 90% of diabetes cases in Sub-Saharan Africa, whilst the other 10% are represented by type 1 diabetes, gestational diabetes, and malnutrition-related diabetes (4,5). Importantly, high prevalence of diabetes was reported in Urban area of North Sudan around 19.1%, while in rural area of North of Sudan the prevalence was estimated to be around Sudan 2.6% and the prevalence of impaired glucose tolerance was 1.6% (6,7).

Type 2 diabetes is a chronic disease requires lifelong integrated treatment. Although, lifestyle modifications are a cornerstone in diabetes management plan, till today the use of anti-diabetes and other medications is an unavoidable step in the disease control for most of the patients. Unfortunately, adherence to anti-diabetic medications is a global problem and in particular in Africa. For instance, In Ghana, the adherence rates to antidiabetic drugs were found to be 38.5%, while adherence rates to antidiabetic drugs in Tanzania were found to be 60.2% and 71.2% at one week and three months respectively (8,9). In large country like India, adherence to antidiabetic medication was found to be around 49.3% (10). Interestingly, the adherence to anti-diabetic medication was found to be around 83.3% in Eastern Uganda (11). In United Arab Emirates, the self-reported adherence rate to anti-diabetic medications was 84%, and forgetfulness was the most common reason for non-adherence (12). Several studies showed that diabetes in Sudan is associated with high levels of complications and majority of patients is not well controlled. For instance, Noor *et al.* showed that in 85% of individuals with diabetes not achieving the HbA1$_c$ glycaemic target (13).

Awadalla *et al.*, Almobarak *et al.* and Elwali reported high prevalence of diabetes complication in Sudanese individuals (14-16). Therefore, the aim of this study is to assess the adherence, knowledge and attitude toward anti diabetic medication prescribed for type 2 diabetic individuals in the main diabetes centre in Khartoum, Sudan.

Methods

A total of 383 individuals with type 2 diabetes, who fulfil the inclusion criteria were interviewed. This study is cross sectional design and screened the knowledge and attitude toward medications prescribed for type 2 diabetic patients in Jabir Abu Elizz Diabetes Canter (one of the main centre for diabetes control in the capital of Sudan, Khartoum). Individuals with diabetes are selected randomly and invited to complete the questionnaire.

Inclusion criteria

All individuals with type 2 diabetes were included in this study.

Exclusion criteria

Individuals with type1 diabetes, gestational diabetes and those aged less than 18 years old were excluded from this study.

Statistical analysis

The data generated was coded, validated and analysed using Statistical Package for Social Science (SPSS) version 20 (IBM Statistics, Illinois, Chicago). Descriptive and percentage of different variables were calculated. The main variables analysed were age, sex, BMI, blood glucose level,

Table 1 Demographic characteristics of the patients

Characteristics	n	%
Gender		
Male	171	45
Female	212	55
Age group (years)		
18–29	18	5
30–44	100	26
45–55	119	31
56–65	146	38
Health insurance status		
Available	293	76.5
Not available	90	23.5
Occupational status		
Don't work	249	65
Working	134	35
Educational level		
Illiterate	84	23
Primary level	129	33
Secondary level	119	31
Graduate level	48	12
Postgraduate level	3	1
Duration of diabetes illness		
Less than 1 year	19	5
From 1 to 5 years	88	23
From 6 to 10 years	107	28
More than 10 years	169	44
Co-morbidities among type 2 diabetics		
Patient with co-morbidities condition	160	41.8
Patient with no co-morbidities condition	223	58.2
Co-morbid condition (N=160)		
Hypertension	92	58
Complication due to hypertension	14	9
Hypertension + dyslipidemia	7	3
Diabetes complications	35	22
Gout	6	4
Asthma	6	4

Table 1 (continued)

Table 1 (continued)

Characteristics	n	%
Rationale use of oral medication		
Metformin	176	46
Glibenclamide	61	16
Glimepiride	38	10
Pioglitazone	5	1.3
Glipizide	1	0.3
ACE	103	27
ARBs	92	24
CCBs	92	24
Diuretics	19	5
B-blocker	35	9
Mainly statin	65	17

ACE, angiotensin-converting enzyme; ARBs, angiotensin receptor blockers; CCBs, calcium channel blockers.

blood pressure and a family history of DM.

Ethical approval

Written consent was obtained from each participant prior to enrolment. All information obtained was kept confidential. An ethical clearance of the research was obtained from the Ethical Committee of the Ministry of Health, Khartoum, Sudan.

Results

Sociodemographic characteristic of the population

The study recruited 383 individuals with type 2 diabetes and 45% were males. Age was between 18 and 65 years old and those between 56 and 65 years old represent 38% of the cohort. Fortunately, (76.5%) of the interviewed patients had a valid health insurance which reflected positively on their ability to receive therapy, especially with 44% have diabetes for more than 10 years. Hypertension was one of the commonest co-morbidities (58%) (*Table 1*).

Knowledge attitudes and practice of patients toward their medication

Seventy three percent (73%) of the patients didn't purchase

Table 2 Knowledge and attitudes of patients toward their medications

Medication purchasing	Details of medication purchasing	%
Medication purchasing process	Patients asserted the purchase of the whole prescription	27
	Patients asserted the purchase of not all prescribed medication	73
Patient's reasons for not purchasing all their medications	Not covered by insurance	31
	Not available at the pharmacy	34
	Expensive medicine	13
	Brand substitution	6
	Unnecessary medicine	8
	More than one reason	8

Table 3 Patient's correct knowledge about anti-hypertensive medication and other medication

Medication	Duration (%)	Drug and food (%)	Frequency (%)	Indications (%)
ACEIs	78	26	96	96
ARBs	100	45	85	95
CCBs	95	20	100	100
B-blockers	100	33	100	89
Diuretics	100	100	75	100

ACE, angiotensin-converting enzyme; ARBs, angiotensin receptor blockers; CCBs, calcium channel blockers.

all their prescribed medications due to one or more reasons varied form one patient to another to include six main reasons as described in *Table 2*. The medicine(s) is not available at the pharmacy or what can be called "out of stock", is the most frequent reason (34%) among patients, and this obstacle faces the patients with health insurance much more than the rest of the population because they have restricted pharmacies to deal with. The second reason is fact that "The medicine(s) is not covered by the insurance" according to this issue approximately one-third of the patients (31%) find themselves forced to either purchase the medication by their own money or just quit it. Third, "The medicine(s) is expensive"; low income, non-working, poly pharmacy and lack of health insurance is the major issues leading (13%) of the patients to consider the medication is expensive and decide not to get it. Other reasons can be found in *Table 2*. The common medication used in treatment of diabetes is metformin (46%) were on Metformin either as monotherapy or in combination with another hypoglycemic agent. Glibenclamide accounted for (16%), glimepiride for (10%),

glipizide for (0.3%) and pioglitazone for (1.3%). The most common antihypertensive medication used are angiotensin converting enzyme inhibitor (27%), angiotensin receptor blocker (24%) and calcium channel blocker (24%). 17% of the study population was receiving lipid-lowering agent; mainly statins (Hydroxy-Methyl-Glutaryl coenzyme A (HMG CoA) reductase inhibitor) (*Table 2*).

Knowledge attitudes and practice of patients toward antihypertensive and other medication (antibiotic, vitamin supplement and aspirin)

Antihypertensive agents
Hypertension was the main co-morbid disease among interviewed patients with a proportion of (58%) as listed in *Table 1*. Furthermore, good compliance with antihypertensive medication, frequency and duration of these medicines (*Table 3*).

Antibiotics, vitamin supplements and aspirin
Diabetic patients are prone to bacterial infections, infection

Table 4 The use of other medication (antibiotic, vitamins and aspirin)

Medication	Name of medication	Percentage of those used the medication
Antibiotics (20%)	Amoxicillin plus clavulonic acid	64
	Ciprofloxacin	14
	Ceftriaxone	12
	Metronidazole	3.3
	Clarithromycin	1.3
	Unidentified antibiotics	7.4
Vitamin supplements	Vitamin B supplements	48
	Iron supplements	11
	Multivitamins	3
Miscellaneous	Low-dose aspirin	84

recurrences and poor outcomes. Irrational and frequent antibiotic use is associated with antibiotic resistance. Therefore, proper selection and usage of antibiotics is crucial. Twenty percent (20%) was receiving antibiotics for various indications. Amoxicillin plus clavulonic acid headed the list with a proportion of 64% among the prescribed antibiotics followed by ciprofloxacin ceftriaxone, metronidazole and clarithromycin (*Table 4*). Specific and multi-vitamin supplements are usually administered to individuals with diabetes to encounter a particular deficiency or to alleviate disease complication. These supplements included vitamin B, iron, folic acid and multi vitamin preparations. Approximately, 48% of the study population received vitamin B supplements. Iron supplements and multivitamins came next by 11% and 3% respectively. Patients on Low-dose Aspirin (as anti-platelet aggregation) where accounted for the highest (84%) proportion of these medications (*Table 4*).

Knowledge attitudes and practice of patients toward insulin therapy

Almost one third (31.7%) of interviewed patients were on insulin. Approximately 72% of these patients were using mixed insulin (70/30), 21% using soluble insulin and 3% used more than one type of insulin at the same time. Two-third of this population usually takes the insulin dose by themselves and 34% of this group rotated injection site routinely in comparison with 66% who stick to one site.

Different aspects regarding this medicine were discussed with the patients, for instance, dose administration, injection sight and storage condition. Insulin proper storage condition must usually follow the manufacturer instructions. Almost all the manufacturers' states; "refrigerate the sealed vial between 2–8 ℃ and store it below 30 ℃ after opening". Unfortunately, in Sudan room temperature rarely drops to under 30 ℃ which necessitated refrigeration of insulin. Majority of the patients (81%) confirmed the storage of insulin vials in the refrigerator while minority (3%) of them stores their vials under Zeer pot refrigerator. 16% of this population preferred to store insulin in other places; coolers, iced steel containers or just on a shelf (*Table 5*).

Discussion

The increase in prevalence of diabetes in Sudan can be attributed in part to the increase in epidemic of obesity, an increase in sugar intake, lack of physical activity and excess carbohydrate intake (17-19). High level of diabetes complications was reported in Sudan. For instance the prevalence of retinopathy was 82.6%, nephropathy 33%, hypertension 39.9%, diabetic septic foot 18% and peripheral neuropathy 68.2% (14-16). In this study, 73% of individuals with type 2 diabetes do not bought all their medication used in diabetes and related co-morbidities. This may in part explain in part the findings of Noor *et al.*; 85% of type diabetes have inadequate glycaemic control (13). The main reason for not buying all medications was attributed to medicine not available, no medical insurance and expensive. Similar problems were also reported in developed and developing countries (8-12).

The study showed that only 17% are on statin therapy. This may in part explain the increase in the incidence of dyslipidaemia and cardiovascular disease in Sudan. For instance, Awadalla *et al.* showed that in individuals with 2 diabetes low HDL is a prominent feature in two thirds of individuals with diabetes and high cholesterol and triglyceride were seen in over one quarter (20). Furthermore, Ahmed *et al.* showed that prevalence of IHD in Sudanese individuals with type 2 diabetes was 5.4% and was associated with hypertension and increase in both age and duration of diabetes (21). Therefore, it's possible to suggest that more health education about cardiovascular risk is needed in Sudan in order to decrease the increase in ischaemic heart disease. The study also showed good compliance with antihypertensive medication. On the other hand, 84% were using low dose of aspirin. The recent guideline recommended that aspirin should not

Table 5 Knowledge and attitudes of patients toward insulin therapy

Rational use of insulin	Methods of administration, storage and types of insulin	%
Insulin	Mixed insulin (70/30)	72
	Soluble insulin	21
	Insulin with zinc	4
	More than one type of insulin	3
Insulin storage conditions among study population	Sample confirmed they store vials in the refrigerator	81
	Stores their vials under dripping "Zeer" clay pot cooler	3
	Store insulin in other places (coolers, iced steel containers or just on a shelf)	16
Evaluation of insulin administration steps	Wash your hands thoroughly with soap and water [32]	40
	Roll your insulin vial gently through your palms before dose withdrawal [18]	22
	Fill your syringe with air in an equal amount to the stated dose [9]	11
	Remove the plastic rubber first, inject the needle and evacuate the air inside [6]	7
	Turn the vial upside down, and then withdraw your dose [9]	11
	Check for absence of air bubbles before injecting the dose (tip gently on the vial) [6]	8
	Rub the area of injection using any antiseptic and place it between two fingers [22]	27
	Inject with 90-degree angle if you are not underweight or too skinny or 45-degree angle way if you are [47]	59

be used in routine basis in individuals with diabetes unless there is secondary causes were found (22). This can be an area for further research to establish whether aspirin therapy and vitamin supplements were used according to guideline. The study showed that individuals with type 2 diabetes need education about diabetes medication, cardiovascular risk and diabetes co-morbidities and education about the need to use different medication like antibiotic in case of infected foot or skins. In large country with low resource setting like Sudan, clinical and community pharmacists can contribute significantly in health education about diabetes medication and medication used to treated related co-morbidities with diabetes. It worth mentioning that, Sudanese pharmacists have sufficient knowledge, attitude and good practice about the management of diabetes (23).

Part of the limitations of this study is cross-sectional design of the study and the temporal relationship. In addition, the study was conducted only in the capital Khartoum so precaution is needed with generalization of the data to the whole of Sudan. However, the study is novel and revealed the need for intensive health education about diabetes medication.

Conclusions

More than two third of Sudanese individuals did not bought all medications used in treatment of diabetes and co-morbidities. Intensive education is needed to increase knowledge of individuals about diabetes in order to enhance attitude and practice. This education can be achieved in part by both community and clinical pharmacists.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Ethical Committee of the Ministry of Health, Khartoum, Sudan and written consent was obtained from each participant prior to enrolment.

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