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## Original Article

## Knowledge, attitude and practice of Sudanese pharmacist with regard to management of diabetes during Ramadan: A cross-sectional survey



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## ABSTRACT

**Background:** Fasting during Ramadan for some individuals with diabetes may lead to complications. Pharmacists may assist in dose adjustment and compliance with medication during Ramadan. Therefore, the aim of this study was to assess the knowledge, attitude and practice of Sudanese community pharmacists in the management of diabetes during Ramadan.

**Method:** A cross-sectional study from April to June 2017, included 330 pharmacies in Khartoum state. The sampling technique was done by two methods using stratified and systematic methods for seven localities of Khartoum State. The community pharmacists were assessed in their knowledge about Medication regimen adjustment (MRA), diabetes risk stratification and the condition in which the fasting diabetic patient have to stop their fast.

**Results:** The total response rate was 311(94.2%), and the females were 203(65.3%). Pharmacists mean age was 27.6 (SD = 5.9), ranged between 21–62 years. Importantly, more than 75% of the Pharmacists have sufficient knowledge of both identifying high-risk individuals and whether they need to break their fasting. The practice questions answered correctly by more than 80% of pharmacists in relation to monitor blood glucose level, undergo meal planning to avoid hypoglycemia and dehydration during prolong fasting hours and to undergo meal choices to avoid postprandial hyperglycemia. Importantly, 56.9% community pharmacists advised individuals with diabetes about physical activity. The barriers that hindering the proper counseling was attributed to the Lack of knowledge (71.4%). MRA was reported as highly important by (56.6%) and extremely important by (39.2%). The confidence of knowledge about MRA was reported by 52.1%.

**Conclusion:** This study showed that pharmacists had sufficient knowledge, positive attitude and good practice about diabetes management during Ramadan.

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## 1. Introduction

Sudan is located in the centre of Africa with a population of 39.58 million, most of them are Muslims. The prevalence of diabetes in Sudan showed a remarkable increase from 3.4% in 2001 to 11.2% in 2013 [1,2]. During the month of Ramadan individuals

refrain from food and drink from sunset to sunrise. Despite the fact that Islam gave an exemption for those individuals with chronic sickness, large numbers of individuals with diabetes do fast during Ramadan [3]. This may lead in some individuals with diabetes, to failure to adjust diabetes medication properly [4]. Individuals with chronic kidney disease especially those with diabetes are at high risk of developing diabetes complications and they should be advised not to fast [5]. Hypoglycemia is one of the common complications with fasting and this may be associated with disturbance of the central nervous system [6]. Obviously, the risk of hypoglycemia during Ramadan is more with type 1 diabetes than type 2

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diabetes. Therefore, a large number of individuals with type 2 diabetes do fast Ramadan [7]. Due to high intake of carbohydrate intake during Ramadan, hyperglycemia is also one of the common complications [8]. The use of some of the sulfonylureas and insulin secretagogues can precipitate hypoglycemia. While the use of metformin,  $\alpha$ -glucosidase inhibitors, thiazolidinediones, and dipeptidyl peptidase-4 inhibitors [9] such as Sitagliptin and Vildagliptin are safe and will aid in the management of Type 2 DM during fasting [10]. The most observed medication regimen adjustments (MRA) in Ramadan were regarding the timings and also decreasing the dose especially in an elderly population with diabetes and this should be combined with regular monitoring [8,11–13]. Therefore, all individuals with diabetes wishing to fast should have a pre-Ramadan (4–6 weeks before Ramadan) assessment with their Health Care Providers. This will include health education about hyperglycemia, hypoglycemia, plan of management and doses adjustment. The physician is also expected to inform these individuals whether it is possible for them to fast or not [14,15]. Knowledge about diabetes and Ramadan is important, as some studies showed some HealthCare providers have insufficient knowledge about diabetes and Ramadan [16,17]. In a large county like Sudan, there is growing role for the pharmacist to provide health advice for individuals with diabetes in particular with regard to dose adjustment of antidiabetic medication during Ramadan. However, providing high-quality consultation for patients who decided to require pharmacists fast to be knowledgeable about the evidence-based guidelines for diabetes care during Ramadan. Therefore the aim of the study was to assess the Community pharmacist's knowledge, attitude & practice towards diabetes management during the month of Ramadan in Khartoum state, Sudan.

## 2. Methods

### 2.1. Study setting

The study was a descriptive cross-sectional survey, the study was conducted from April to August 2017, in community pharmacies of Khartoum State, Sudan. The study populations were the registered community pharmacists by the Ministry of Health in Khartoum state.

### 2.2. Study participants and data collection

The ministry of health reported that there are 1872 community pharmacies in Khartoum state. As the number of the total pharmacies is known, the equation of Known population was used to calculate the sample size as follow:

$$n = \frac{N}{1 + N(e)^2}, \quad n = \frac{1872}{1 + 1872(e)^2}, \quad n = 329.6$$

N = target population, n = sample size, e = margin of error (0.05).

The sample size was 330 pharmacies. We used stratified sampling method; Khartoum state is divided into seven localities by the Government of Khartoum State" Ministry of Planning and Urbanization, and we considered each locality stratum, then within each locality (stratum) the systematic sampling method was used to select the community pharmacies in which we targeted the registered community pharmacists regardless if they are pharmacy managers or pharmacy leaders. The questionnaire consisted of 4 items: 6 Socio-demographic questions, 5 practice questions, 10 Knowledge questions and 7 attitude questions. The questionnaire was tested in ten community pharmacies as a pilot study, and these pharmacies were excluded when the study was conducted.

The data were analyzed by using SPSS version 23 (IBM, Chicago, USA) and Excel version 16. We used descriptive statistics (Frequencies, Cross tabulations) and inferential statistics (correlations, independent sample T-Test & Oneway ANOVA and Logistic Regression). The section that assessed the respondent's knowledge consisted of a series of questions related to recommendations for diabetes patient medical assessments and drug dosing, derived from previously published studies [8,18–20]. The evaluation of community Pharmacist's knowledge about MRA, the Knowledge assessing part was designed and adjusted as follow: Patient risks stratification (four statements), safety parameters for breaking the fasting (three statements) and Drug dosing adjustment (three statements). A further Seven statements addressing the pharmacists' attitudes towards their confidence answering the questionnaire and importance of this study, Also towards the perceived barriers that are hindering the diabetes patient care and counseling (five statements). A three-point Likert scale ranging from "Agree" passing "Neither" to "Disagree" was used to assess the responses of the participants to the Perceived former barriers.

## 3. Results

### 3.1. The Sociodemographic characteristic of participants

The response rate of the community pharmacists in this study was (94.24%), and the females were 203(65.3%). Pharmacists mean age was 27.6 (SD = 5.9), ranged between 21–62 years. Most of the participants had a bachelor degree (265, 85.2%) with 1–5 years of practice. Respondents who did not attend to any workshop about Medication Regiment adjustment (MRA) regarding diabetes mellitus were 236 (75.9%). The Sociodemographic characteristic of

**Table 1**  
Sociodemographic features.

Variables	Features of variables	Frequency (%)
Religion	Muslim	306 (98.4)
	Others	5 (1.6)
Sex	Male	203 (65.3)
	Female	108 (34.7)
Age		Mean 27.6 (SD = 5.99)
Education level	Baccalaureate	265(85.2)
	Masters	46(14.8)
Years of practice	Less than 1 year	53(17)
	1–5 years	205 (65.9)
	6–10 years	42 (13.5)
	More than 10 years	11 (3.5)
Diabetes care Workshop attendance	Yes	75 (24.1)
	no	236 (75.9)

participants was presented in Table 1.

### 3.2. Knowledge regarding medication regimen adjustment

Regarding the knowledge, questions included 10 statements. Three of the ten statements, were about the adjustment of the medication regimen doses, four questions about the assessment of the risk during fasting and related complications, and the other three statements were concerned about the conditions in which the individuals with diabetes should break their fast, the correct answer responses of the ten statements were shown in Table 2. Importantly, more than 75% of the Pharmacists have sufficient knowledge of both identifying high-risk individuals and whether they need to break their fasting. However, for questions related to the adjustment of the medication regimen doses the score for correct answers were between 32 to 43%. Crosstabulation and Chi-square test were used to determine if there is an association between the participated community pharmacist's Knowledge and their confidence regarding their therapeutic knowledge about MRA, and the result was Statistically significant ( $p$ -value = 0.046) and to determine if there is an association between the participated community pharmacist's Knowledge and their Importance, the result was Statistically significant ( $p$ -value = 0.010). Also, we performed a  $\chi^2$  test to determine the association between the Knowledge and the Some Demographic characteristics

(Educational Level and years of Practice in addition to Contribution of Pharmacists who attended to the Workshops), the results were Statistically Insignificant ( $p$  values were 0.322, 0.466 and 0.498 respectively). Logistic Regression test was performed, and the only result that was statistically significant as a knowledge predictor was the importance of knowledge ( $P$ -value 0.005, Odd Ratio 1.839), although, the association of the participant's attitude towards their confidence of knowledge and knowledge was statistically insignificant, it's contribution as a knowledge predictor was high ( $P$ -value 0.465, Odd Ratio 1.24) (Table 3).

### 3.3. Questions regarding attitudes

Pharmacists who answered the questions regarding the importance of MRA in the pharmacy, revealed the following categories: Not important at all (1%), slightly important (3.2%), high important (56.6%) and extremely important (39.2%). Pharmacists confidence regarding their therapeutic knowledge about MRA were: Not confident at all (15.4%), slightly confident (52.1%), high confident (24.1%) and extremely confident (8.4%). The study also showed the attitude of Pharmacists towards some of the selected barriers that limit the Pharmacists participation in DM patient care during Ramadan. We found that "lack of knowledge (71.4%)" was the most important barrier that the pharmacist agreed on (Table 2).

**Table 2**  
Community pharmacist's responses regarding knowledge, attitude and practice questions.

Questions about Knowledge	Correct Answer	Correct Response
<b>Risk category for fasting complications:</b>		
Well-controlled using Metformin.	Low risk	55.3%
Well-controlled using Sulfonylurea.	Moderate risk	50.2%
Patient with recurrent hypoglycemia.	High risk	78.8%
Elderly and ill patient.	High risk	78.5%
<b>when patient should break their fast:</b>		
If blood glucose drops to less than 60 mg/dl.	Yes	91.6%
If blood glucose drop to equal or less than 70 mg/dl in morning.	Yes	75.6%
If blood glucose exceeds 300 mg/dl.	Yes	84.6%
<b>Medication regimen adjustment during Ramadan:</b>		
55 years old Type 2 DM take Metformin 500 mg TID.	1000 mg at Iftar and 500 mg at Suhoor	43.7%
Type 2 DM who eat large meal at Iftar& small meal at Suhoor.	Long-acting insulin at Suhoor shouldn't recommended	34.7%
35 Years old Type 1 DM patient well-controlled take 20 unit at 9.a.m & 15 unit before each meal.	unit should adjust to 16 unit at Suhoor	32.8%
<b>Questions regarding practice</b>		
<b>Do you advice the diabetic patients to:</b>		Correct response
to monitor their blood glucose level during the fasting and non-fasting hours		81.7%
to undergo meal planning to avoid hypoglycemia and dehydration during prolong fasting hours		84.2%
to undergo meal choices to avoid postprandial hyperglycemia		82.6%
about timing and intensity of physical activity during Fasting		56.9%
<b>Questions regarding attitude:</b>		
<b>the importance of MRA in pharmacy:</b>		Correct response
Not important at all		1%
slightly important		3.2%
high important		56.6%
and extremely important		39.2%
<b>Pharmacist's confidence regarding their therapeutic knowledge about MRA:</b>		
confident at all		15.4%
slightly confident		52.1%
high confident		24.1%
and extremely confident		8.4%
<b>Barriers that limit the Pharmacist's participation in DM patient care during Ramadan:</b>		
		Percentage of those agreed
Lack of knowledge		71.4%
Lack of privacy and counseling area,		53.1%
Insufficient time and Crowding of pharmacy		61.4%
Patient uninteresting		62.1%

**Table 3**

Associations of participated community pharmacist's knowledge and their predictors by using Logistic Regression test (n = 311).

	B	S.E.	Chi <sup>2</sup>	P value	Odds ratio
Importance	.609	.215	8.012	.005	1.839
Confidence	.284	.165	2.984	.084	1.329
Age	-.010	.031	.110	.740	.990
Gender	-.153	.288	.283	.595	.858
Educational Level	-.242	.347	.487	.485	.785
Years of Practice	.019	.266	.005	.943	1.019
Workshop	.215	.294	.535	.465	1.240
Constant	-1.524	1.385	1.212	.271	.218

#### 3.4. Community pharmacists practices during Ramadan

The practice questions answered correctly by more than 80% of pharmacists in relation to monitor blood glucose level during the fasting and non-fasting hours, to undergo meal planning to avoid hypoglycemia and dehydration during prolong fasting hours, to undergo meal choices to avoid postprandial hyperglycemia. However, 56.9% of pharmacist correctly answered the question about timing and intensity of physical activity during Fasting (Table 2).

#### 4. Discussion

During the last 10 years, the emerging role of pharmacist in the management of diabetes during Ramadan has gained popularity. Amin and Chewning (2014) showed large number of pharmacists are willing to learn about management of diabetes during Ramadan [20]. Our study showed that more than 75% of the Pharmacists have sufficient knowledge in both identifying high-risk individuals and whether they need to break their fasting. This indicate pharmacist can independently identify individuals that fasting can increase morbidity and mortality. Pharmacist scored between 50 to 55% in identifying those individuals with low and moderate risks (especially in stratification of the low and moderate risks when compared with that of high risk). This can be attributed to the fact that besides Ramadan fasting is religious event, majority of pharmacist feel comfortable to advise those with high-risk individuals not perform fasting. While, those with moderate and mild risk to seek advice from their physician. Wilbur et al., in 2017 showed that patient perception of the pharmacist ability is one of the important factor that encourage pharmacist to continue with diabetes counseling and education [21]. The level of knowledge of Sudanese pharmacists about diabetes and Ramadan is very good and at the same standard of pharmacists in Qatar and healthcare professionals in Singapore [19,22].

Medication regimen adjustment (MRA) during Ramadan for individuals with diabetes seem to represent challenges not only to pharmacist but also to general practitioners and general physician (not specialist in diabetes) [20,23–26].

For instance, Amin and Chewning in 2016 showed that only 16% of the pharmacists initiated conversation about MRA days before Ramadan [24]. In study of 298 pharmacists, 94.2% reported performing MRA on small percentage of patients. The study also showed the factors that can influence MRA such as pharmacist perceived behavioral capability, pharmacist perceived patient benefit and number of working hours [27]. In this study around 60% of pharmacist agreed that patient's attitudes towards pharmacist and crowding of the pharmacy can be barriers. Elhadj et al., in 2018 studied the role of pharmacist in management of diabetes not exclusively during Ramadan. Their data showed that 45% of pharmacists are able to provide therapy recommendation for physician [25]. Importantly, in cross-sectional study of 274 general

practitioners (GP), 40% of them responded incorrectly to question related to MRA [26]. Therefore, it is not surprising to find score of Sudanese pharmacists for questions related to adjustment of the medication regimen doses, were between 32 to 43%. However, Pharmacists responses to question regarding the importance of MRA on pharmacy, revealed a high importance of MRA knowledge. In addition, MRA was significantly associated with importance and confidence. This may explain that with further education and training, pharmacist in Sudan may play important role in management of diabetes. Furthermore, Logistic Regression test showed that attitude regarding the importance of knowledge was the only significant predictor (P-value = 0.005 and Odd ratio 1.8). This can be translated into possibility that pharmacists with positive attitude regarding the importance of knowledge were more likely to increase their knowledge by 1.8 time more than the pharmacists with negative attitude. The shift in attitude and practice of pharmacist is being proposed not only in the field of diabetes but also in the management of cardiovascular disease [25,28]. It worth mentioning, that one of the barriers that pharmacists are aware that it can hinders their progress in management of diabetes was the Lack of knowledge (71.4%). Almansour et al., in 2017 suggested the need to develop protocols to help patients as well as training and skills development for pharmacists [29]. Amin and Chewning suggested early communication with individuals with diabetes will help to overcome the barrier of medication adjustment [24]. The practice questions answered correctly by more than 80% of pharmacists in relation to monitor blood glucose level, undergo meal planning to avoid hypoglycemia and dehydration during prolong fasting hours and to undergo meal choices to avoid postprandial hyperglycemia. Importantly, 56.9% community pharmacists advised individuals with diabetes about physical activity. Therefore, it is possible to conclude that Sudanese pharmacists have sufficient knowledge, positive attitude and good practice about diabetes management during Ramadan.

The current study suggest that there is role of pharmacist in management of diabetes during and after Ramadan. This important in large country with low resource setting like Sudan due to these reasons (i) The high prevalence of diabetes in Sudan and this estimated to be 19% in the north of Sudan [30](ii) the increase in prevalence of uncontrolled diabetes for both type 1 and type 2 (estimated to be 85%) [30,31](iii) the increase in prevalence of obesity among Sudanese population with and without diabetes [32,33](iv) the high prevalence of diabetes complications like retinopathy, nephropathy, heart disease and diabetic septic foot [34].

This study is not without limitations. The cross-sectional design may not allow for generalization of the results to the whole population of the pharmacists. The study also included pharmacist from the community and not those working in hospitals or universities. Despite these limitations, we consider the findings of this study are novel and this first study in Sudan to assess the role of pharmacist in management of diabetes during Ramadan.

#### 5. Conclusion

This study showed that pharmacists had a sufficient knowledge, positive attitude and good practice about diabetes management during Ramadan. We recommended that frequent educational interventions of pharmacist are essential to pursue local and national guidelines for diabetes management during fasting [35]. This should be in association with protocol disseminated to the public about the role of the pharmacist in management of diabetes during Ramadan in order to improve the pharmacist perceived patient benefit. Ultimately, this may encourage health authorities in Sudan to promote bigger role for pharmacist in management of diabetes.

The deployment of pharmacist in diabetes control program can be an important and cost-effective ways for reducing the prevalence and complications of diabetes and should be advocated by the health authorities and the public in Sudan.

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### Conflicts of interest

None.

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