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Primary Health Care Physicians' Knowledge about Managing Diabetic Patients Before and During Ramadan in Alexandria: A Mixed Methods Study

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ABSTRACT

Background: Primary care professionals have a key role in managing changes to therapeutic regimens for diabetes mellitus (DM) patients intending to fast the holy month of Ramadan. Objective: To assess the primary healthcare physicians (PCPs)/family physicians (FPs) knowledge about care of diabetics' care during fasting Ramadan and exploring facilitating factors and barriers for gaining knowledge about good diabetes care before and during Ramadan. Methods: A cross-sectional mixed quantitative and qualitative study design was conducted by using a pre-designed self-administered questionnaire to assess level of knowledge of 53 PCPs/FPs followed by the qualitative phase that consisted of semi structured interviews with a purposive sample of 12 PCPs/FPs guided by the theory of planned behaviour. Results: The average total knowledge score for all respondents was 55.8%. Only 3.8% of PCPs/FPs had a good overall knowledge. As for knowledge levels by risk stratification for diabetic patients, approximately 62% of PCPs/FPs scored less than 50%. Over 56% of PCPs/FPs had a score above 75% on pre-Ramadan health education. Meanwhile, 5.7% scored above 75% on knowledge regarding managing diabetics throughout Ramadan. Attitudes towards knowledge seeking in diabetes management varied based on personal or patient benefits, motivation, educational qualifications, fear of accountability, and patient willingness. Barriers to knowledge acquisition included workload, workforce shortages, geographical location, and information dissemination methods. Conclusions: The study identified knowledge gaps in preparing PCPs/FPs to manage patients' therapeutic regimens during fasting in Ramadan, highlighting the importance of specific training and management of barriers.

INTRODUCTION

Fasting during Ramadan, a fundamental aspect of Islam, involves abstaining from eating and drinking between dawn and sunset. The lunar year is shorter than the solar year, making Ramadan untied to a specific season. However, fasting is obligatory for all able-bodied adult Muslims, except for whom fasting may be detrimental to their health.[1]

During Ramadan, patients' health behaviors are significantly altered, including changes in diet, medication use, sleep patterns, and physical activity.[2] Diabetic patients are particularly vulnerable due to fluctuations in blood glucose levels during fasting,[3] increasing their risk of complications like hypoglycemia, hyperglycemia, and diabetic ketoacidosis.[4,5] Proper risk stratification, knowledge of anti-diabetic drugs, modifications to drug regimens during Ramadan, and patient education can reduce the risk of complications.[6] Many diabetic patients who choose to fast may adjust their medication regimens independently or seek advice from health professionals.[7]

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The Epidemiology of Diabetes and Ramadan (EPIDIAR) study found that, in spite of the risk, over 42% of patients with type 1 diabetes and nearly twice that percentage of patients with type 2 diabetes fasted for at least 15 days during Ramadan.[8] A recent study in Pakistan found that one-third of general practitioners lacked adequate knowledge about principles of managing diabetes during Ramadan.[9]

Primary healthcare physicians (PCPs) play a key role in preventing complications for diabetic patients. They spend more time with patients and are frequently consulted for a variety of health problems.[10] A recent study in Saudi Arabia found a significant knowledge gap in patients with type 2 diabetes attending a diabetes clinic and concluded that there should be strengthening of the pre-Ramadan education program for patients.[11] Adherence to guidelines by PCPs has shown improvement in the health outcomes of diabetic patients, though this is generally observed in non-Ramadan contexts.[12]

PCPs and family physicians (FPs) should work with their patients and other health professionals to achieve safer fasting in Ramadan. They must have an understanding of current guidelines for managing diabetes in Ramadan and reflect on implementing their knowledge with their Muslim patients in the context of evidence-based medicine and shared decision-making.[13]

There is no lack of international guidelines dealing with fasting during Ramadan for diabetic patients, the most comprehensive – an evidence-based guideline- being the International Diabetes Federation (IDF) Diabetes and Ramadan International Alliance (DAR) published in 2017. The guideline covers both medical and religious issues concerning fasting Ramadan.[1] However, Egyptian national guidelines for managing diabetes in Ramadan are lacking.

The absence of national Egyptian guidelines for managing diabetes during Ramadan, was the main reason for carrying out the present study, as an attempt to assess the current level of knowledge of Egyptian PCPs/FPs. In addition to trying to explore the reasons behind physicians' behavior towards gaining updated knowledge concerning diabetes management during Ramadan.

METHODS

A mixed quantitative (cross-sectional- descriptive study) and qualitative (in-depth interviews) methodology was used to conduct the study in all nine family health centers in Alexandria Governorate at the time of the study.

A total sample of 53 PCPs/FPs agreed to participate representing 88.3% of all physicians working in the included study settings and approached to be part of the quantitative part of the study for assessment of their knowledge about managing diabetic patients before and during Ramadan.

A purposive sample of PCPs/FPs were recruited according to the sampling strategy for the qualitative part to study the barriers and facilitators for acquiring up to date knowledge for providing good diabetic care in relation to Ramadan. Twelve interviews were conducted for the qualitative part of the study till reaching saturation of key themes and preliminary analysis indicated no new data emerging.[14] The sampling strategy took into consideration variance in age, gender, and years of practice.

Data collection tools: Data collection was done through the following tools: (A) Quantitative part: A pre-set self-administered questionnaire testing knowledge was designed based on the 2017 Diabetes and Ramadan International Alliance (DAR) and the International Diabetes Federation (IDF) collaborative guidelines titled Diabetes and Ramadan practical guidelines.[1] The questionnaire included: (1) Socio-demographic characteristics: age, sex, year of graduation, qualification, years of experience, and previous training in DM management either in Ramadan or in general and source of knowledge. (2) Knowledge assessment questions were divided into three sections as follows: Risk stratification for individuals with diabetes during Ramadan: this section included 7 questions. Pre-Ramadan education: this section included 8 questions. Diabetes management during Ramadan: this section included 9 questions.

The questionnaire included 24 knowledge questions, for each correct answer, a score of one was given. Each incorrect or unknown answer, a score of zero was given. The total knowledge score was 24 points, and it was categorized into three levels: poor physician's knowledge <50%, fair physician's knowledge 50%-74%, and good physician's knowledge ≥75%.

The questionnaire was constructed in collaboration with three experts (a PHC professor, a clinician and a pharmacist) with an extensive number of publications on the topic. One of those experts was the primary author of the 2017 Diabetes and Ramadan (DAR) International Alliance and the International Diabetes Federation (IDF)

collaborative guidelines. Cognitive interviewing involving three primary care clinicians reading the questions out loud to ensure that the items were understood the way they were intended.[15]

Table 1: Characteristics of PCPs/FPs in studied FHCs in Alexandria (n = 53)

Characteristics	No.	%
Gender		
Female	50	94.3
Male	3	5.7
Age (years), mean±SD	43.52 ±10.95	
Years of practice, mean±SD	17.96 ±10.37	
Educational qualification *		
Bachelor of medicine	19	35.9
Post-graduate diploma	13	24.5
Egyptian fellowship of family medicine	20	37.7
International membership of the royal college of general practitioners	6	13.3
Arab board of family medicine	3	5.7
Master's degree	4	7.6
Missing	2	3.8
PCPs/FPs who had general DM training		
Had training	36	67.9
Had no training	16	30.2
Missing	1	1.9
PCPs/FPs who had specific Ramadan DM training		
Had training	29	54.7
Had no training	23	43.4
Missing	1	1.9

** Total adds to > 100% as some participants had multiple educational credentials. Data were presented as number and percentage unless otherwise mentioned.*

A pilot study was done on nine PCPs/FPs. Those who were enrolled in the pilot study were not included in the final analysis. Pilot testing showed that the language was easy to understand, and some participants commented on the difficulty of several items and necessary modifications were done.

(B) Qualitative part: An in-depth semi-structured interview questionnaire based on the theory of planned behavior was designed covering the following:[16] *The attitudes* (a settled way of thinking or feeling about something) of PCPs/FPs towards the perceived value of training regarding care of diabetics fasting Ramadan. *The subjective norms* i.e., "perceived social pressure to perform or not to perform the behavior" concerning: (1) Patient needs and requests. (2) Fellow PCPs/FPs attitudes towards knowledge acquisition about managing diabetics fasting Ramadan. (3) The perceived attitude of Key Opinion Leaders (KOL) e.g., faculty professors, consultants, and specialists, on PCPs/FPs, prescribing or modifying diabetic drug regimens.

The perceived behavioral control (i.e., "the perceived ease or difficulty of performing the behavior") of PCPs/FPs in: (1) Individual barriers and facilitators and performing pre-Ramadan counseling and risk stratification for diabetic patients as well as management of diabetic patients in relation to Ramadan. (2) Environmental factors: The perceived attitude of the administrative authority on PCPs/FPs towards clinician's gaining knowledge about diabetic care in relation to Ramadan

The first author of the research conducted interviews which took place in family health centers (FHCs) where PCPs/FPs and FPs worked. The interview began with a question on the typical encounter with a diabetic patient visiting the FHC before or during Ramadan. After rapport was established with the PCPs/FPs, the interview then moved towards open-ended questions exploring the key constructs of the theory of planned behavior. The use of silent probes, elaboration and restatement of questions was used to get more in-depth responses.

The mean duration of interview was around 19 minutes (range 10-33 minutes). Interviews were recorded on a digital audio recorder, then transcribed verbatim into document files and revised by two of the researchers for any mistakes or incompleteness, as interviews were conducted in Arabic, the transcribed interview files were translated to English.

Statistical analysis: Data were reviewed, coded, verified, and statically analyzed using computer package Statistical Package for the Social Sciences (SPSS) version 25, and STATA for content analysis of the qualitative data. Quantitative data were described using mean, range (minimum and maximum), and standard deviation for the total score and for each section of the questionnaire. ANOVA test, independent t test and Pearson Correlation were used in testing correlations. Qualitative data were analyzed through the narratives of participants and direct content analysis based on the interview guide components; analysis was done by fitting individual narratives into the theory of planned behavior (TPB) main constructs.

Table 2: Knowledge of PCPs/FPs regarding aspects of care provided to diabetics intending to fast Ramadan (n = 53)

Questions	Correct answers N (%)
Risk stratification for diabetics fasting during Ramadan	
1. Diabetic patients with history of hypoglycemic attacks considered to be at the highest risk for fasting during Ramadan	42 (79.2)
2. Diabetic patients with chronic kidney disease (CKD) stage 4 being considered as of moderate to low risk for fasting during Ramadan	39 (73.6)
3. Diabetic patients with acute illness are considered to be of moderate to low risk for fasting during Ramadan	19 (35.8)
4. Adults with type 1 or type 2 diabetes intending to fast, should be individually assessed prior to Ramadan by six to eight weeks	9 (17.0)
5. A type 1 diabetic with a pre-Ramadan HbA1C >9% being at very high risk	17 (32.1)
6. A pregnant woman with diabetes or gestational diabetes mellitus treated with insulin considered being at very high risk	6 (11.3)
7. Type 1 diabetes is considered being at high risk	25 (47.2)
Pre-Ramadan education for diabetics fasting during Ramadan	
1. Very high-risk patients choosing to fast in Ramadan should check their blood glucose regularly	52 (98.1)
2. Blood glucose level below which diabetic patient is advised to stop fasting. (Below 70 mg/dL (3.9 mmol/L))	36 (67.9)
3. Frequency of self-monitored blood glucose testing per day during fasting in Ramadan for type 1 DM patients? (More than three times)	25 (47.2)
4. Well-controlled patients treated by lifestyle and metformin only being required to carry out self-monitored blood glucose testing	32 (60.4)
5. Patients with diabetes should be encouraged to take regular light-to-moderate exercise during Ramadan	34 (64.2)
6. Healthy nutritional habits for a diabetic patient during Ramadan should Ensure meals contain 45–50% carbohydrate, 20–30% protein and <35% fat	44 (83.0)
7. When breaking the fast because of hypoglycemia, patients should not consume a small amount of a slow-acting carbohydrate	33 (62.3)
8. Indicative symptoms for a diabetic patient to break his\her fast	45 (84.9)
Diabetes management during Ramadan for diabetics fasting during Ramadan	
1. The type of anti-diabetic medication can influence hypoglycemic risk during fasting	46 (86.8)
2. Sodium-glucose co-transporter-2 (SGLT2) inhibitors (e.g. canagliflozin, dapagliflozin) in Ramadan can't be used with renal impairment patients	15 (28.3)
3. Dosage of Extended-release formulation of metformin (Glucophage / Cidophage)	44 (83.0)
4. For a diabetic patient using only metformin three times daily and intending to fast, dose modification should be: Morning dose to be taken before suhoor / Combine afternoon dose with dose taken at Iftar	23 (43.4)
5. The usage of insulin secretagogues/meglitinides e.g. repaglinide in Ramadan	23 (43.4)
6. Usage of Sulphonylureas in fasting diabetic patients	21 (39.6)
7. The adjustment of pioglitazone (a thiazolidinedione, Actos™) dose during Ramadan	18 (34.0)
8. The dosage and administration adjustment of Glucagon-like peptide-1 receptor agonists (e.g., liraglutide) in fasting diabetic patients in Ramadan	14 (26.4)
9. The dosage and administration adjustment of short acting insulin in fasting type 2 diabetic patients in Ramadan	33 (62.2)

RESULTS

Table (1) showed that most participants were females (94%). Participants' mean age was 43 years with a Standard Deviation ± 11 (SD) and ranged from 26 to 59 years. On average, participants had a practicing experience of 18 years. Sixty percent (60%) of participants had postgraduate credentials while 40% had only a Bachelor of Medicine degree. Nearly two thirds (67.9%) of the participants had received general diabetes mellitus (DM) training, with more than half of the participants (54.7%) had received specific Ramadan DM training.

Table (2) illustrates knowledge of PCPs/FPs regarding aspects of care provided to diabetics intending to fast Ramadan. In relation to PCPs/FPs' knowledge regarding risk stratification for diabetics fasting during Ramadan, the results revealed that most participants (79.3%) correctly identified attacks of hypoglycemia to be the highest risk for fasting and 73.6% identified the risk stratification for diabetics with CKD stage 4. However, only 17% identified the ideal time for a pre-Ramadan individualized assessment and 11.3% identified the risk stratification for pregnant women with diabetes or gestational diabetes mellitus treated with insulin. Pre-Ramadan education knowledge assessment section was better answered by PCPs/FPs, with 98.1% of participants correctly answering a question about regular blood glucose checks and symptoms not indicating a fast break (84.9%).

Table 3: Knowledge level of PCPs/FPs about different aspects of care provided for diabetic patients in relation to fasting during Ramadan (n = 53)

	N	%
Risk stratification of people with diabetes who choose to fast during Ramadan		
Poor (<50%)	33	62.3
Fair (50% – <75%)	17	32.1
Good (≥75%)	3	5.6
Min. - Max.	1-7	
Mean ± SD.	3.23 ±1.38	
Pre-Ramadan education of people with diabetes who choose to fast during Ramadan		
Poor (<50%)	23	43.4
Fair (50% – <75%)	17	32.1
Good (≥75%)	13	24.5
Min. - Max.	3-8	
Mean ± SD.	5.7 ±1.27	
Diabetes management for people with diabetes who choose to fast during Ramadan		
Poor (<50%)	39	73.6
Fair (50% – <75%)	12	22.6
Good (≥75%)	2	3.8
Min. - Max.	2 – 9	
Mean ± SD.	4.67 ± 1.56	
Total knowledge score level		
Poor (<50%)	14	26.4
Fair (50% – <75%)	37	69.8
Good (≥75%)	2	3.8
Min. - Max.	7 – 18	
Mean ± SD.	13.38 ± 2.69	

Data were presented as number and percentage unless otherwise mentioned. Min., minimum; Max., maximum

However, a question about frequency of self-monitoring of blood glucose was difficult to answer correctly (47.2%).

Regarding PCPs/FPs' knowledge about management of diabetics fasting Ramadan, 86.8% of participants correctly identified the type of anti-diabetic medication which can influence hypoglycemic risk during fasting, while 83.0% correctly identified the correct use of extended formulation of metformin by diabetic patients during Ramadan. Meanwhile, the lowest number of participants identified correctly the use of sodium-glucose co-transporter-2 (SGLT2) inhibitors (28.3%) and Glucagon-like peptide-1 receptor agonists (26.4%) in fasting diabetic patients in Ramadan.

Table (3) demonstrated that the knowledge levels of PCPs/FPs about risk stratification for diabetic patients who fast during Ramadan were generally poor. Nearly two third (62.3 %) of participants failed to answer correctly half of the questions in this section, with only 5.7 % of participants achieving more than 75 % of question answered correctly. Participants achieving a fair knowledge level between 50 % - 75 % were 32.1 % of the total. The average score for this section was 3.23 out of 7 (about 46 %) with a SD of ±1.38 and a range of 1–7.

Knowledge of PCPs/FPs regarding Pre-Ramadan education for diabetics fasting during Ramadan was better than the previous section. Participants achieving scores of more than 50% on this section were 56.6 % of those, 32.1 % had fair knowledge level and 24.5 % had good knowledge level. The average score for this section was 5.7 with a standard deviation of ±1.27, the scores ranged from 3-8.

Knowledge among PCPs/FPs about diabetes management during Ramadan for diabetic patients was poor, almost three quarters (73.6 %) of the participants scored less than 50% in this section. Almost a quarter of participants 22.6 % scored above 50 % yet less than 75 %, while only 3.8 % achieved more than 75 % on this section. The average score for this section was 4.67 with a standard deviation of ±1.56, the scores ranged from 2-9.

Regarding the total knowledge score, more than 90% of participants scored 75% or less with poor (26.4%) and fair (69.8%) knowledge levels, while only 3.8 % of participants and had good level of knowledge scoring above 75%. The mean knowledge score for all respondents was 13.38 with a SD of ± 2.69 (an average score of 55.7 %). Out of 24 question items, the number of total correct answers identified by participants ranged from 7 to 18.

No participant answered all questions correctly; the maximum score achieved was 18 out of 24 questions and was achieved by only 2 participants. While the least score achieved by a participant was 7 questions out of 24 (1 participant).

Table (4) showed that there was no significant statistical relation found between the previous attendance of training about DM or DM in Ramadan and the total knowledge score. Age, and years of actual medical practice had no statistically significant relation with total knowledge scores.

Table 4: Relation between characteristics of PCPs/FPs with total knowledge score:

	Knowledge score		p-value
	Minimum-maximum	Mean ± SD	
Educational Qualification of			
Bachelor of Medicine [1]	7.0 – 17.0	12.53 ± 2.48	0.010*
Single post-graduate qualification [2]	8.0 – 17.0	13.19 ± 2.68	
Two post-graduate qualification [3]	16.0 – 18.0	17.25 ± 0.96	
Three post-graduate qualification [4]	15.0 – 15.0	15.0 ± 0.00	
Attendance of Previous training of DM:			
Yes	7.0 – 17.0	13.41 ± 2.65	0.932
No	9.0 – 18.0	13.33 ± 2.97	
Attendance of Previous training in DM inRamadan:			
Yes	7.0 –17.0	13.34 ± 2.84	0.907
No	9.0 –18.0	13.43 ± 2.61	
Sociodemographic characteristics			
Age	26-59	43.52 ± 10.95	0.732
Years of actual medical practice	1-35	17.96 ± 10.37	0.915

**Significance between categories 1&3, 2&3, and 3&4*

Female gender and having double post- graduate qualification were found to be statistically significantly associated with higher aggregate knowledge scores ((r=0.33; p<0.05) and (f= 4.26; p<0.05) respectively).

Facilitating Factors and Barriers: The study explores the facilitating factors and barriers to gaining knowledge about good diabetic care before and during Ramadan. The qualitative research results were presented using the theory of planned behavior (TPB) constructs. Most participants were females (n = 10, 83%), with only two male physicians interviewed. The average participant's years of experience was 16.25 years (SD ± 9.94) and ranged from 6 years to 30 years.

(1) Attitudes of PCPs/FPs regarding adjusting therapeutic regimens

The study results revealed that physicians' positive attitudes towards seeking updated knowledge about managing diabetic patients fasting during Ramadan were driven by personal gain and patient benefit.

The study found that several participants cited the challenge of having no local source of information for adjusting therapeutic regimens for patients with diabetes intending to fast during Ramadan. Meanwhile, a patient with diabetes herself, GP Physician (E), reflected on her own situation, explaining that knowledge about diabetes and Ramadan would be safer and reduce the probability of complications related to fasting. She recalled self-adjusting her anti-diabetic medication doses during Ramadan and emphasized the importance of adjusting insulin doses for patients prescribed large doses of insulin to avoid hypoglycemia.

(2) Attitudes of PCPs/FPs regarding the involvement in diabetic patient care

The level of involvement of PCPs/FPs in patient care during Ramadan varied among participants. Some physicians, such as Physicians (D), (E), and (F), all agreed on limiting their involvement to offering lifestyle modification advice. Moreover, Physician (D) feared complications and uncertainty about their role as family physicians, stating: *"I am not a specialist, I don't intervene."*

Specialist and consultant family physicians were more willing to be involved in adjusting therapeutic regimens for diabetic patients fasting during Ramadan. However, GPs with no specialist degree in family medicine or limited years of experience were not willing to get involved. Physician (I), a family medicine specialist, preferred to get involved only if the patient was well controlled before Ramadan: *"I have the right to intervene anytime as a family medicine specialist."*

Patient willingness to be managed by PCPs/FPs was identified as a factor responsible for determining the level of involvement. Non-compliant patients were less willing to be managed by a PCPs/FPs, while compliant patients were more willing to be managed by a PCPs/FPs.

Patient perceptions of a primary care provider's role also played a role in their willingness to be managed

by PCPs/FPs. Physician (I) described a situation where she believed that *"resistant patients"* had no confidence in a PCPs/FPs being the suitable healthcare provider for their condition: *"We try with him (the resistant patient) once, twice, and thrice, and if I can't do anything with him (adjust therapeutic regimen), then I refer him to the specialist (internal medicine specialist)."* Physician (H) was reluctant to modify therapeutic regimens for diabetic patients as she was confronted by work system regulations.

Both Physicians (B) & (L), family medicine consultants, were in favor of PCPs/FPs getting involved with modifying therapeutic regimens for diabetic patients, citing better knowledge compared to internal medicine specialists. Physician (B) believed that he was obliged to refer his patients to an internal medicine specialist due to local guidelines.

Almost all participants encountered situations where they found their knowledge inadequate for providing patient care for diabetics during Ramadan, most of which occurred in their early years of practice. Physician (D) recalled recurring situations where she had been asked if a patient should fast during Ramadan, responding: *"I begin offering health education regarding the red alerts and danger signs."*

Physician (A) explained his approach when confronted with questions regarding fasting diabetic patients during Ramadan, saying: *"Frankly, I am asked on many occasions about topics I don't know the answers to, so I say to the patient, 'I will prepare an answer for you by your next visit,' or I refer him to a senior colleague."*

(3) Subjective Norms

The study results revealed that patients expect their treating physicians to have answers for all their questions about diabetes during Ramadan. However, patients do not expect doctors to receive training on this topic due to low expectations of PHC centers in Egypt. Physicians also emphasized the importance of maintaining trust with patients and updating their knowledge, as stated by Physician (C): *"Yes, of course, they have great trust in us... they know that you have the latest (information or knowledge), so you must update yourself."*

Most participants believed that most fellow PCPs/FPs actively seek new or updated information on managing diabetic patients during Ramadan. However, some participants believed that only a few colleagues actively seek training due to their educational background: "*Unfortunately, there are doctors whose experience has stopped with what they see every day… they are not willing to learn something new; they just want to keep on doing what they are doing."* Egyptian Board of Family Medicine trainees or graduates are more likely to actively seek training about managing diabetic patients during Ramadan than other physicians with higher degrees. Physicians attributed seeking knowledge or training about managing diabetic patients during Ramadan to age, years since graduation, and mental attitude. Younger physicians showed more interest in learning and seeking updated knowledge. Older doctors were less willing to seek knowledge and were more stationary with their information, as mentioned by Physician (A): *"Mostly the older ones (physicians) are the ones who are stationary with their information and are not willing to take courses or read something... the young ones are more willing to learn."* Recently graduated physicians have more time and a higher drive for seeking knowledge, which leads to better working opportunities in the MOHP, private practice settings, or even outside Egypt.

Opinions on how Key Opinion Leaders (KOLs) saw Primary Care Physicians seeking knowledge about diabetic care in Ramadan showed discrepancy. Some believed KOLs were encouraging PCPs/FPs to seek knowledge and training, while others viewed them as incapable and thought they should not be involved, as reported by Physician (B): *"I don't think they (KOLs) trust primary healthcare... they imagine that primary healthcare physicians don't have enough knowledge, or they cannot diagnose well, or they cannot deal with the patient properly."*

Attitudes towards family medicine and primary healthcare are growing, but misunderstandings persist. Governmental perspectives suggest that KOLs are encouraging PCPs/FPs to seek training and knowledge to reduce workloads and provide more time for patients needing specialist opinions. Private practice environments may also favor financial gains to attract patients to their clinics. That opinion was stated by Physician (A): *"It differs how a doctor sees it, in the family health unit or in the Ministry of Health compared to a private doctor... it's purely financial."*

However, some participants recognized KOL opinions as positive towards their involvement in managing diabetic patients during Ramadan. Some believed that KOLs positively identified the role of PCPs/FPs, as they are the first HCPs to see patients and should utilize their knowledge and expertise to the maximum before referring patients to higher

levels of healthcare. Physician (K) shared the opinion of KOLs on seeking knowledge about diabetic care by PCP: "I think fair people will encourage something like that"

(4) Perceived Behavioral Control

The study results revealed that many physicians believed it is easy to seek knowledge and training about diabetic care during Ramadan. However, several barriers hinder this process. One such barrier is the lack of local Egyptian guidelines for managing diabetes during Ramadan; Physician (D) pointed this out, saying: *"Is there a treatment protocol during Ramadan? No… there are no guidelines about diabetes... nothing for Ramadan, no definite protocol for Ramadan… there are no instructions that we should refer patients to internal medicine for modifying doses."*

The study also highlighted physicians' beliefs about possible facilitating factors, such as the availability and accessibility of training. Training held at a geographic location near the participant or online was considered a facilitating factor: *"It would be better if it was held in the center here."* However, a distant location for the training venue made it more difficult for participants to access training.

Some participants suggested implementing hotlines connected to experts on the matter, providing institutional access to medical websites, and utilizing Drug Information Centers (DIC) in their family health centers (FHCs). Other facilitating factors included propagating updated guidelines through smartphone applications, availability of printed media, and functioning computers and internet access in FHCs.

Barriers to seeking knowledge and training during Ramadan include time constraints, increased workload, workforce shortages, and unjustified selection of trainees or attendees. Physician (J) also complained of not being able to attend any training due to workforce shortages: *"Even if you get a chance to improve yourself, they say to you: 'This can't be done—we have a shortage of doctors; you can't go for a training course.'"*

Participants in the study expressed varied opinions on their supervisors' and administrative authority's support for diabetic patient care training during Ramadan. Most perceived support was in nominating PCPs/FPs for workshops or training courses organized by the health department or health district administration. However, some physicians expressed no support for training, citing bureaucracy and arbitrary choices: *"They want you to be here and manage the visiting patients."*

Participants preferred interactive lectures, case discussions, presentations, clinical study presentations, clinical examination videos, live demonstrations, and more inclusive workshops as methods for training on managing diabetics in Ramadan. Some participants wanted lectures delivered by Faculty of Medicine staff members.

DISCUSSION

The current study utilized a mixed-method design to address research questions that neither quantitative nor qualitative methods could answer alone. This approach helps understand connections or contradictions between qualitative and quantitative data, allows participants to voice their experiences, and facilitates exploration that enriches evidence and answers questions more deeply. It also fosters greater scholarly interaction and enriches researchers' experiences.[17]

Primary healthcare physicians (PCP) must consider their patients' spiritual needs when managing diabetic patients during fasting Ramadan. Knowledge about managing diabetic patients who choose to fast during Ramadan is crucial for informed decision-making. However, the current study found that PCPs/FPs have inadequate knowledge levels regarding the aspects of care provided for fasting patients. The highest inadequacy was found in the management of diabetic patients who fast during Ramadan. The inadequacy may be due to the limited availability of antidiabetic drugs in family medicine drug lists and the limited private practice of participants. Evidence-based guidelines recommend switching to newer generations of Sulphonyl Ureas (SUs) due to their lower risk of hypoglycemia.[1] However, the medications included in the Egyptian family medicine drug list are of older generations SUs, with no substitutes available.[18]

The perception of some PCPs/FPs viewing their role in managing diabetes during Ramadan to be limited to patient education may lead to inadequate knowledge and motivation for modifying therapeutic regimens. The lack of local Egyptian guidelines about diabetes management during Ramadan may also contribute to this lack of motivation.

The motivation for searching for and using international guidelines may have been met with skepticism by the Ministry of Health and Population (MOHP) audit teams. This practice would have raised questions about the reasons why PCPs/FPs modified a therapeutic regimen on their own rather

than referring the patient to an internal medicine specialist.

Physicians' knowledge level regarding patient education was better than in other sections of the questionnaire but not adequate. Knowledge levels regarding pre-Ramadan patient education for people with diabetes who choose to fast during Ramadan were good, with over 56% of participating PCPs/FPs scoring more than 50% in this section. This may be due to the nature of PHC services emphasizing the prevention of diseases and possible complications rather than just managing ongoing conditions.

Studies have shown better diabetes outcomes with patient education. Ahmedani et al. found that the pre-Ramadan estimated average blood glucose decreased dramatically during Ramadan, attributed to two sessions provided to diabetic patients before Ramadan.[19] A retrospective case-control study found that patients who attended an educational program about diabetes and fasting Ramadan reported more body weight loss and decreased hypoglycemic events.[20]

In Singapore, Zeinudin et al's study in 2018 reported a high overall knowledge level among a group of healthcare professionals attending a pre- Ramadan diabetes education training with an average score of more than 80%,[21] while the current study's lower knowledge scores of physicians may be attributed to the different demographic characteristics of participants. On the contrary, in 2016, Ahmedani MY et al. assessed the knowledge, attitude, and practices of general practitioners (GPs) in Pakistan, finding that many GPs lack appropriate knowledge about diabetic patient care.[9]

A study conducted in Jordan by D. Jaber et al. found that recently graduated and family physicians scored higher than other specialties and had a greater tendency to instruct their patients to fast during Ramadan.[22] This goes with the opinion of consultants and FPs of the current study who showed more willingness to get involved in the management of DM patients in Ramadan.

In Turkey, Yılmaz et al. assessed the approaches and awareness of family physicians on diabetes management during Ramadan. More than 50% of FPs in Yılmaz's study stated their reason for referral of a diabetic patient choosing to fast during Ramadan as they lack sufficient knowledge or experience.[23] This is similar to data from the current study when interviewing PCPs in Alexandria who feared to interfere, causing harm to their patients due to insufficient knowledge.

While other studies found age and years of practicing medicine influencing knowledge levels generally, Yilmaz did not find a statistical relation between years of practice, age, and knowledge levels.[23] In the current study, no statistically significant relation was found between total knowledge score and previous attendance of training about diabetes in general or DM in Ramadan, specifically reflecting the insufficiency of such training; meanwhile, having double postgraduate qualification was significantly associated with a higher knowledge level.

A study in Ottawa, Canada, explored the perspectives and concerns of PCPs when receiving diabetic patients coming back from specialist care and highlighted the availability of a specialist for advice as a facilitating factor for caring for diabetic patients,[24] similarly, as whished by the participants of the current study for the presence of a hotline for consultations. Barriers to this transition of DM patients back to primary care were the lack of confidence of patients in PCPs' abilities in managing diabetes, again which was in agreement with the opinion of the Egyptian PCPs/FPs in the current study, who mentioned their point of view of the lack of confidence of the patients in their abilities to provide them with the optimum healthcare.

CONCLUSIONS

The current study reveals that PCPs/FPs working in FHCs in Alexandria, Egypt, have insufficient overall knowledge about the care of diabetes patients fasting Ramadan. Their attitudes towards learning about diabetes care differ depending on the advantages to the patient or the individual, and that lack of medication availability and workplace restrictions deters people from obtaining information. Participation is also influenced by educational background, apprehension about responsibility, and the desire of the patient. Knowledge acquisition is hindered by factors such as labour shortages, geographic location, information transmission techniques, and workload.

Ethical Consideration

An approval was taken from the Ethics Committee of the High Institute of Public Health, Alexandria University, and from the MOHP Scientific and Research Ethics committee (IRB0000687), for conducting the research. Verbal consent was obtained from the participants in the study and upon recording interviews with them. Anonymity and confidentiality were assured and maintained. The

International Guidelines for Research Ethics were complied with. There was no conflict of interest.

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