Interns And Residents' Level Of Literacy And Practice Regarding Diabetes Mellites Management During Ramadan Fasting In Family And Medicine Departments

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Abstract
Our evidence based clinical practice with diabetic patients especially in Ramadan fasting mainly formed from clinical research . Through literature review, it has been found out that there are various articles published for the awareness of patients and general population regarding safe fasting during Ramadan. But very few studies highlight the Ramadan specific knowledge of general practitioners engaged in providing care to people with diabetes, In this study ,we aimed to to assess level of literacy and practice of interns and residents in family and medicine departments in King Abdul-Aziz university regarding diabetes mellites management during Ramadan fasting, to provide baseline data to inform best implementation practices of guidelines to optimize the management of diabetes during Ramadan. Doctors were invited to participate in a cross-sectional double blinded online-based survey. Target population were interns and residents in family and medicine departments in King Abdul-Aziz university within 6 months starting during 2023, The survey included items related to doctors level of education about fasting in Ramadan for diabetic patients and their information providers, the type of patient who should not fast ,

symptoms of hypo and hyper-glycemia , healthy habits in fasting and timing and frequency of blood glucose measuring, . The analysis included descriptive statistics and group comparison. Out of the 83 responses, knowledge and educational level were slightly higher in family doctors, While both groups exhibit similar levels of general knowledge, key differences emerge in areas such as dietary counseling, medication adjustments, and identifying high-risk patients. These findings highlight the need for targeted educational interventions to optimize patient care.It is suggested that the doctors should receive training regarding latest published guidelines to minimize variety in management plans between them .

1. INTRODUCTION

Diabetes mellitus is the most common chronic endocrine disorder, affecting an estimated 9.3% of the adult population globally in 2019 and it has a large impact on society [1]. Fasting during the month of Ramadan, the 9th lunar Islamic month ,is 1 of the 5 pillars of Islam [2]. During Ramadan, fasting entails adult Muslims' abstinence from food, water, all oral substances that include intravenous fluid therapy, from dawn to sunset [3]. While the Koran exempts specific people from fasting, such as the acutely ill, those who are old and frail, travelers, menstruating women, pregnant and nursing mothers, as well as those with chronic diseases (such as diabetes mellitus), many Muslims with diabetes insist on fasting during Ramadan, and they choose to do so against the advice of their doctors [2,4,5].The Epidemiology of Diabetes and Ramadan (EPIDIAR) study, a large epidemiological study of 12243 Muslims with diabetes in 13 different Muslim countries, revealed that 79% of Muslims with type 2 diabetes fasted for more than 2 weeks during Ramadan [6]. However, the practice of fasting during Ramadan for adults with diabetes is known to carry significant risks and complicate the management of diabetes. The EPIDIAR study showed a significant increase in severe hypoglycemic episodes during Ramadan compared with other months.[6] Other complications of fasting for patients with diabetes during Ramadan include hyperglycemia, dehydration [6], volatility of blood sugar levels, especially for patients on insulin and sulfonylurea medications [7], fluctuations in lipids, renal function [8], and body composition [8,9].The impact of Ramadan fasting on health and disease stems from the biological impact of prolonged fasting on physiological and pathological parameters of disease states [10]. Ramadan fasting has also been associated with drastic societal changes in lifestyle and eating habits during Ramadan, often manifested as increases in consumption of carbohydrate- and fat-rich foods, along with alterations in the sleep-wake cycles [3]. The former aggregation of abrupt physiological and lifestyle changes, prompted by Ramadan fasting, creates significant challenges in patients' medical care during the holy month. Additionally, with the increasing level of complexity of chronic diseases and therapeutics, healthcare providers cannot rely solely on personal anecdotes, impressions, or even consensus to manage disease during Ramadan [11,12]. Diabetic patients who fast during Ramadan also pose a challenge for health care providers, as clinicians need to provide additional education and while emphasizing the need for closer blood glucose monitoring during the fasting period. Several studies have shown that if fasting diabetic patients are properly educated and trained well, then they can safely and effectively engage in this practice [2,13–16). Providers are calling for strong evidence for the development of disease-specific guidelines during the month of Ramadan [17]. In the last decade there has been several management recommendations by different groups [18-24]. Despite the increasing volume of Ramadan fasting literature in previous years, significant concerns exist regarding the quality of evidence and its robustness in altering or improving practices [11,12,17]. Current knowledge and research on diabetes and Ramadan

fasting form the basis for evidence-based clinical practice. In this context and to further navigate the case of research on Ramadan fasting, we aim to explore interns' and residents' perceptions of current knowledge gaps relating to diabetes and Ramadan fasting. We aim to assess their level of literacy and practice regarding Diabetes Mellites management during Ramadan fasting in family and medicine departments in King Abdul-Aziz university to provide baseline data to inform best implementation practices of evidence and guidelines to optimize the management of diabetes during Ramadan.

2. METHODS

2.1. Survey development

Questionnaire adapted to assess knowledge, attitude and practices of interns and residents regarding Ramadan and diabetes.

2.2. Context and data collection

An online questionnaire was formulated to survey the interns and residents. Target population were interns and residents in family and medicine departments in King Abdul-Aziz university within 6 months starting during 2023.

2.3. Analysis

Data was entered into Microsoft excel sheet. Statistical analysis was done by using SPSS (statistical package for social science) version 27. Qualitative data was expressed as numbers and percentages. Chi-square test was used as a test of significance for qualitative data. Quantitative data was expressed as mean and standard deviation. Statistical significance was considered when P value is less than 0.05.

3. RESULTS

There was a total of 83 doctor responded. Of these, 22 (26.5%) were internal medicine and 61 (73.5%) were family medicine, (38(45.8%)) were male and(45(54.2%)) were females, their mean age was (30.31±4.585)years ,Family medicine doctors had slightly higher experience years (5 vs 3) than internal medicine doctors ,The study investigated doctors education About Fasting in Ramadan for Diabetic Patients "Feel you need to know more about managing diabetes during Ramadan": High proportions of respondents in both groups(81.9%) felt the need, but no significant difference was observed (p = .528).

"Did you ever receive any information regarding managing diabetes in Ramadan?": Both groups reported similar experiences about (88.5%) (p = .790) ."Did you receive any information within the last year?": Family medicine respondents reported slightly higher receipt (75.4% vs. 59.1%), though not statistically significant (p = .148).

And for providers of Ramadan education, Contributions from consultants formed largest proportion (54.2%) and approached significance (p = .051), Other sources showed no statistically significant disparities, Timing of Ramadan education,Most education occurred before Ramadan (63.9% total), with no significant timing differences (p = .359). And type of Ramadan education received,"Change in medication dose": Family medicine respondents significantly reported higher receipt (72.1% vs. 36.4%, p = .005).

"When to break the fast": Significantly higher education reported by family medicine (75.4% vs. 50.0%, p = .036).

"Dietary advice": Notably more prevalent among family medicine respondents (60.7% vs. 22.7%, p = .008).

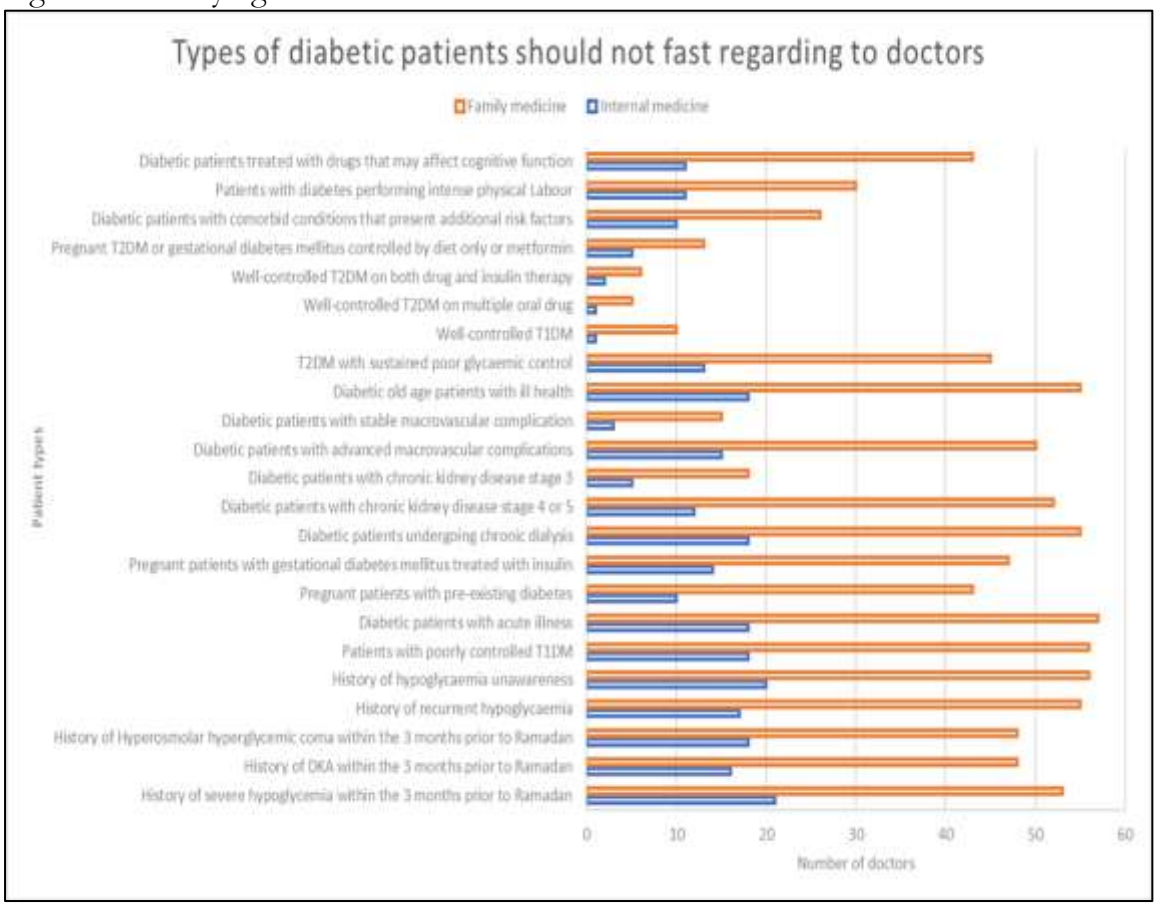
Table 1: Education About Fasting in Ramadan for Diabetic Patients

Topic	Internal medicine	Family medicine	Total	P-value
feel you need to know more about managing diabetes during Ramadan?	19 86.4%	49 80.3%	68 81.9%	.528
Did you ever receive any information regarding how to manage diabetes in Ramadan?	19 86.4%	54 88.5%	73 88.0%	.790
Did you receive any information regarding how to manage diabetes in Ramadan within last year?	13 59.1%	46 75.4%	59 71.1%	.148
Provider of Ramadan education you received within the last year				
Senior resident	3 13.6%	3 4.9%	6 7.2%	.325
Hospital professor	4 18.2%	12 19.7%	16 19.3%	.863
Academic educational books	3 13.6%	15 24.6%	18 21.7%	.512
Internet	8 36.4%	17 27.9%	25 30.1%	.287
Printed media	2 9.1%	19 31.1%	21 25.3%	.106
Specialist	4 18.2%	14 23.0%	18 21.7%	.531
Consultant	9 40.9%	36 59.0%	45 54.2%	.051
Others	0 0.0%	8 13.1%	8 9.6%	.203
Timing of Ramadan education you received within the last year				.359
Before Ramadan	11 50.0%	42 68.9%	53 63.9%	
During Ramadan	2 9.1%	3 4.9%	5 6.0%	
After Ramadan	0 0.0%	1 1.6%	1 1.2%	
Type of Ramadan education you received within the last year				
Change in medication timing	12 54.5%	43 70.5%	55 66.3%	.284
Change in medication dose	8 36.4%	44 72.1%	52 62.7%	.005
Complications of fasting	11 50.0%	39 63.9%	50 60.2%	.097
Management of complications	9 40.9%	37 60.7%	46 55.4%	.254
When to break the fast	11 50.0%	46 75.4%	57 68.7%	.036
Dietry advice	5 22.7%	37 60.7%	42 50.6%	.008

Topic	Internal medicine	Family medicine	Total	P-value
Advice related to exercise	5 22.7%	32 52.5%	37 44.6%	.051

Regarding patients who should not fast in Ramadan ,History of hypoglycemia unawareness was the most frequent cause (91.6%) and then diabetic patients with acute illness (90.4%) , Least chosen cause was well controlled type 2 on multiple oral drugs (7.2%) .Significant differences were observed regarding patients with chronic kidney disease stage 4 or 5 (p = .003) and pregnant patients with pre-existing diabetes (p = .036).

Figure1: Identifying Patients Who Should Not Fast



Regarding frequency and timing of blood glucose measuring in those fasting patients ,no significant differences were noted for monitoring frequency (p = .275), with most respondents advocating multiple daily checks (72.3%) . Measuring glucose "when symptomatic " had the highest percentage across groups (96.4%). There were no statistically significant differences (all p-values > 0.05). About (19.3.%) of doctors agreed that measuring blood glucose using skin prick in Ramadan impairs fasting with no significant difference (p-values = .632) .

Table 3: Frequency and Timing of Blood Glucose Monitoring for Fasting Diabetic Patient in Ramadan

Topic	Internal medicine	Family medicine	Total	P-value
Does measuring blood glucose using the skin prick method invalidates fasting?				
	5 22.7%	11 18.0%	16 19.3%	.632
How many times at least should the blood glucose level of a diabetic patient who is fasting get measured daily during Ramadan?				**.275**
is not important to measure blood glucose levels daily during Ramadan	0 0.0%	3 4.9%	3 3.6%	
Only when sick	0 0.0%	3 4.9%	3 3.6%	
Once	1 4.5%	0 0.0%	1 1.2%	
Twice	5 22.7%	11 18.0%	16 19.3%	
More than 3 times	16 72.7%	44 72.1%	60 72.3%	
When **to measure blood glucose level during Ramadan for a fasting diabetic patient?**				
Before sohoor	17 77.3%	42 68.9%	59 71.1%	.455
After sohoor	14 63.6%	45 73.8%	59 71.1%	.369
During the day	17 77.3%	49 80.3%	66 79.5%	.761
Before iftar	19 86.4%	53 86.9%	72 86.7%	.951
After iftar	17 77.3%	43 70.5%	60 72.3%	.542
During the night	10 45.5%	30 49.2%	40 48.2%	.764
When symptomatic	22 100.0%	58 95.1%	80 96.4%	.289
When sick	21 95.5%	57 93.4%	78 94.0%	.734

While for healthy habits in Ramadan , all asked habits had relatively high percentage except for rigorous exercise(19.3%),Highest were high adherence to balanced diets (100%) and regular exercise (97.6%).Intake of high-fiber foods was significantly more recognized in family medicine (93.4%) than internal medicine (72.7%, p = 0.011).

Table 4: Healthy Habits for Diabetic Patients During Ramadan

Topic	Internal medicine	Family medicine	Total	P-value
Healthy habits during Ramadan for diabetic patients				
Healthy balanced diet	22 100.0%	61 100.0%	83 100.0%	
low energy release foods and minimizing saturated fat foods	20 90.9%	55 90.2%	75 90.4%	.919
Using small amount of monounsaturated oil	14 63.6%	48 78.7%	62 74.7%	.164
High fiber foods intake is required for the duration of Ramadan	16 72.7%	57 93.4%	73 88.0%	.011
Regular balanced exercise	21 95.5%	60 98.4%	81 97.6%	.446
Rigorous exercise	6 27.3%	10 16.4%	16 19.3%	.267
Continuity of usual physical activity	21 95.5%	51 83.6%	72 86.7%	.160
Tarawih prayers is part of the exercise regimen	15 68.2%	41 67.2%	56 67.5%	.934
It is preferred to delay sohoor	18 81.8%	55 90.2%	73 88.0%	.303
Does fasting help control blood glucose level	18 81.8%	44 72.1%	62 74.7%	.370

Figure 2: Symptoms of Hypoglycemia

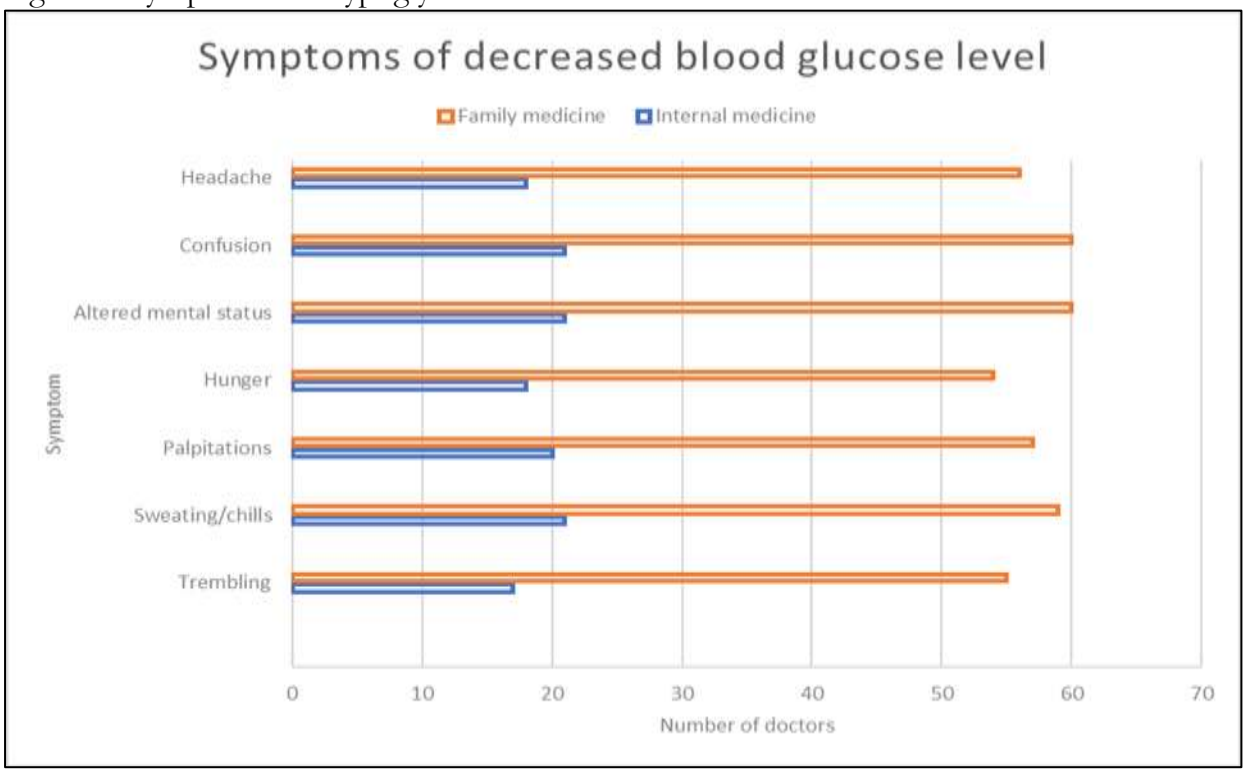
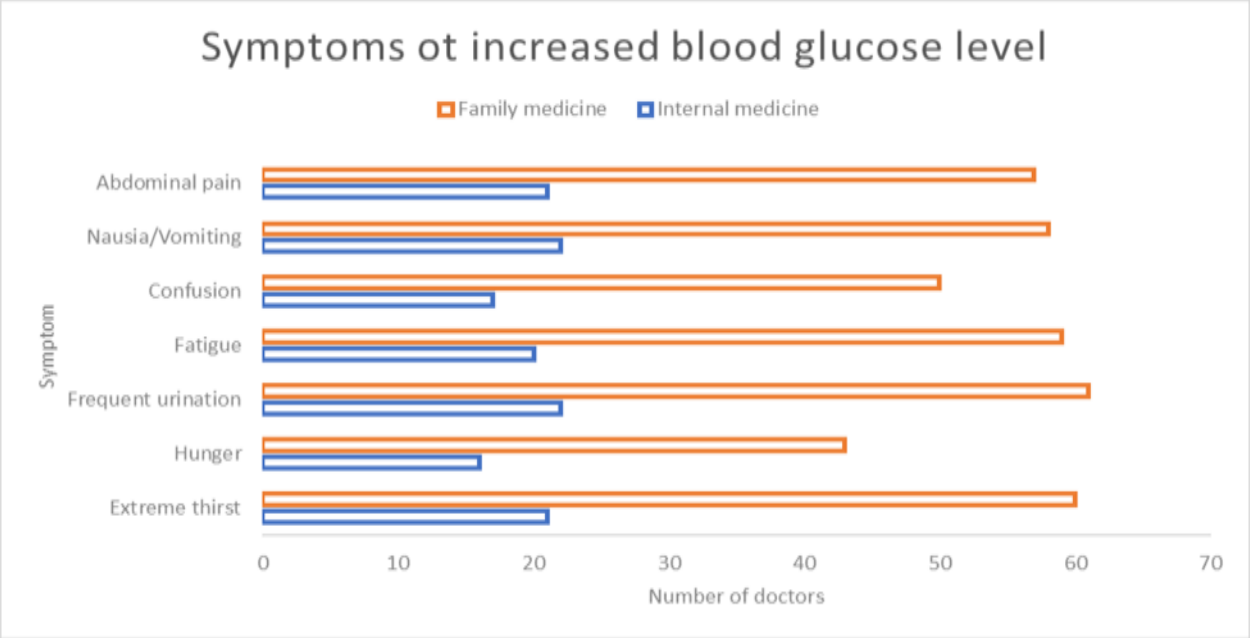


Figure 3: Symptoms of Hyperglycemia



Regarding symptoms of low blood glucose (e.g., sweating 96.4%, trembling 86.7%) and high blood glucose (e.g., frequent urination 100%, thirst 97.6%) were well recognized across both groups.
No significant differences in symptom recognition were observed (all p-values > 0.05).

Table 5: When Should Diabetic Patient Break Fasting
Majority of doctors (73.5%) saw that diabetic patients should break fasting when both hypoglycemic and hyperglycemic symptoms appear.

	Internal medicine	**Family medicine**	**Total**	**P-value**
When should a diabetic patient break fasting during Ramadan				**.316**
Hyperglycemia	1 4.5%	1 1.6%	2 2.4%	
Hypoglycemia	6 27.3%	10 16.4%	16 19.3%	
Both	13 59.1%	48 78.7%	61 73.5%	
Don't know	2 9.1%	2 3.3%	4 4.8%	

Regarding medication adjustment in Ramadan, Adjustments for long-acting insulin during Ramadan were significantly more frequent in family medicine (80.3%) than internal medicine (59.1%, p = 0.016). Adjustments for medications like Metformin and Sitagliptin and Dapagliflozin were infrequent (7-8% recognition).
Rapid-acting insulin adjustments were recognized by a majority (83.1%)
Table 7: Adjustments in Diabetes Medication Dosages

Topic	Internal medicine	Family medicine	Total	P-value
dose of Metformin during fasting changes during Ramadan	11 50.0%	27 44.3%	38 45.8%	.897
the dose of one tablet before eating 3 times will be during Ramadan				.256
1) Two tablets after night Breakfast and one tablet after Sohor.	9 40.9%	38 62.3%	47 56.6%	
2) Two tablets before Sohor and one tablet after Breakfast.	3 13.6%	3 4.9%	6 7.2%	
3) I do not know	3 13.6%	8 13.1%	11 13.3%	
The dose of Gliclazide during fasting changes during Ramadan	12 54.5%	41 67.2%	53 63.9%	.379
the dose is one tablet or more before morning breakfast. At Ramadan, it will be				**.459**
1) Same as with sohor	2 9.1%	6 9.8%	8 9.6%	
2) Same as before night breakfast	11 50.0%	39 63.9%	50 60.2%	
3) I do not know	4 18.2%	10 16.4%	14 16.9%	
The dose of long acting INSULIN (Glargine, Detemir, Degludec) changes during Ramadan	13 59.1%	49 80.3%	62 74.7%	.016
the dose of long acting insulin (Glargine, Detemir, Degludec) is modified , it will be				**.078**
1) Reduced from 15 to 30 percent.	12 54.5%	42 68.9%	54 65.1%	
2) Reduced to from 40 to 50 percent.	1 4.5%	6 9.8%	7 8.4%	
3) I do not know	3 13.6%	9 14.8%	12 14.5%	
The dose of rapid acting insulin changes during Ramadan	19 86.4%	50 82.0%	69 83.1%	.788
the dose of rapid acting insulin is modified , it will be				.272
1) Two times (before breakfast and half the dose with Sohor)	15 68.2%	47 77.0%	62 74.7%	
2) Two times (before sohor and half the dose with Breakfast)	3 13.6%	2 3.3%	5 6.0%	
3) I do not know.	2 9.1%	9 14.8%	11 13.3%	
The dose of sitagliptin, vildagliptin changes during Ramadan	2 9.1%	4 6.6%	6 7.2%	.159
The dose of dapagliflozin Empagliflozin, Canagliflozin changes during fasting at Ramadan .	2 9.1%	4 6.6%	6 7.2%	.075
The dose of Dulaglutide, Semaglutide, and Liraglutide changes during fasting in Ramadan .	2 9.1%	5 8.2%	7 8.4%	.129

A trend towards earlier check-ups (1-2 weeks) was more prevalent in both family medicine and internal medicine doctors , though not statistically significant (p = .186).

Table 8: Pre-Ramadan Risk Factor Check-Up Timing

4. DISCUSSION

Diabetes mellitus is the most common chronic endocrine disorder, many Muslims with diabetes insist on fasting during Ramadan, and they choose to do so against the advice of their doctors [2,4,5].

Diabetic patients who fast pose a challenge for health care providers, as clinicians need to provide additional education and while emphasizing the need for closer blood glucose monitoring during the fasting period, several studies have shown that if fasting diabetic patients are properly educated and trained well, then they can safely and effectively engage in this practice [2,13–16). Providers are calling for strong evidence for the development of disease-specific guidelines during the month of Ramadan [17].Almost one third of the studied populations of general practitioners across Pakistan lack the knowledge of basic principles that are important to be employed in the management of diabetes during

Topic	**Internal medicine**	**Family medicine**	**Total**	**P-value**
When should patient attend clinic for pre-Ramadan risk factor chick up				**.186**
1) 1-2 weeks before Ramadan	9 40.9%	26 42.6%	35 42.2%	
2) 3-5 weeks before Ramadan	7 31.8%	9 14.8%	16 19.3%	
3) 6-8 weeks before Ramadan	4 18.2%	23 37.7%	27 32.5%	
4) More than 2 months before Ramadan	2 9.1%	3 4.9%	5 6.0%	

Ramadan[25] .Another study showed that the healthcare professionals had good knowledge and were capable in managing Muslims with diabetes during fasting themselves[26] ,Mean knowledge score was 81.1%. Eighty-four percent would counsel people with diabetes for fasting, increasing to 96.7% after education[26] . The findings of the present study, showed that the level of knowledge regarding Diabetic patient management in Ramadan fasting is very close between family doctors and medicine doctors with slightly higher level between family medicine doctors, while for providers of Ramadan Education, Contributions from consultants approached significance (p = .051), suggesting their role might differ slightly between specialties. Other sources showed no statistically significant disparities, highlighting similar education sources for both groups, and for timing of Ramadan education, most education occurred before Ramadan (63.9% total), This aligns with the emphasis on preemptive patient preparation. Type of Ramadan Education Received "Change in medication dose": Family medicine respondents significantly reported higher receipt (72.1% vs. 36.4%, p = .005),"When to break the fast": Significantly higher education reported by family medicine (p = .036).

"Dietary advice": Notably more prevalent among family medicine respondents (60.7% vs. 22.7%, p = .008).While for Identifying Patients Who Should Not Fast ,Significant differences were observed regarding patients with chronic kidney disease stage 4 or 5 (p = .003) and pregnant patients with pre-existing diabetes (p = .036). These findings may indicate varied recognition between groups. No significant differences were noted for blood glucose monitoring frequency (p = .275), with most respondents advocating multiple

daily checks. Measuring glucose "before iftar" had the highest consistency across groups (86.7%), showing significant adherence among doctors.
Measuring glucose "when symptomatic" also showed a high percentage (96.4%), There were no statistically significant differences (all p-values > 0.05), indicating uniformity across internal and family medicine groups. Regarding healthy Habits for Diabetic Patients During Ramadan,High adherence to balanced diets (100%) and regular exercise (97.6%).
Intake of high-fiber foods was significantly more recognized in family medicine (93.4%) than internal medicine (72.7%, p = 0.011).No significant differences were found in recommending or types of medication changes (p-values all > .05), suggesting broad agreement across specialties. Regarding symptoms of Hypo- and Hyperglycemia
Symptoms of low glucose (e.g., sweating 96.4%, trembling 86.7%) and high glucose (e.g., frequent urination 100%, thirst 97.6%) were well recognized across groups.
No significant differences in symptom recognition were observed (all p-values > 0.05).
Adjustments for long-acting insulin during Ramadan were significantly more frequent in family medicine (80.3%) than internal medicine (59.1%, p = 0.016). Adjustments for medications like Metformin and Sitagliptin and Dapagliflozin were infrequent (7-8% recognition). Rapid-acting insulin adjustments were recognized by a majority (83.1%).In comparison with a previous study , 75.9% provided counselling or adjusted medication whilst 51.1% managed diabetes complications, with 63.8% predominantly hypoglycaemia, 11.6% predominant hyperglycaemia and 24.6% only hypoglycaemia [26].
A trend towards earlier check-ups (1-2 weeks) was more prevalent in family medicine, though not statistically significant (p = .186).

5. CONCLUSION

The findings revealed that level of knowledge and education of doctors regarding care of diabetic patients in Ramadan is accepted. Although, the general knowledge levels of the two groups are comparable, significant distinctions can be shown in areas like identifying high-risk individuals, dietary counselling, and medication modifications. In order to maximize patient care, these findings emphasize the necessity of focused educational initiatives. There must be a strong evidence for the development of disease-specific guidelines during the month of Ramadan, In order to do that, providers are requesting solid evidence .Various organizations have made a number of management recommendations in the past ten years .The quality of the evidence and its ability to change or improve practices are major problems, even if the amount of literature on Ramadan fasting has increased in recent years .Evidence-based healthcare therapy is based on the most recent research .It is suggested that the doctors should receive training regarding latest published guidelines to minimize variety in management plans between them .

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Ethical approval
The study has been approved by the Research Ethics Committee (REC)at King Abdul-Aziz university KAU

Informed consent
Participants were informed verbally about the study before enrolments. The participation was completely voluntary and anonymous.

Author contribution
The author confirms sole responsibility for the following: study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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