Perception and Behaviour of Type 2 Diabetes Patients towards Diabetes Management during Ramadan

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Abstract

Introduction: Fasting during the holy month of Ramadan is one of the five pillars of Islam. There are exemptions for those who are not in a good health. Nevertheless, many Muslims still insist to fast even though their health conditions are discouraging and this could lead to health complications.

Objective: This study aimed to explore the perception and behaviour of Muslims with Type 2 Diabetes Mellitus (T2DM) in Hospital Tuanku Ampuan Najihah (HTAN) towards diabetes management during Ramadan.

Methods: Semi-structured interview sessions were conducted from August to October 2018 at HTAN medical clinic. Purposive sampling method was used to recruit Muslim respondents with T2DM aged 18 years and above who were prescribed with at least one antidiabetic agent. The interview topic guide consisted a series of open-ended questions related to diabetes management during Ramadan including perception of fasting, diabetes management, diet control and self-monitoring blood glucose (SMBG) practice. All the interviews were audio recorded and transcribed verbatim. Data collection was discontinued after saturation was achieved.

Results: A total of thirty T2DM patients were interviewed. Majority of the respondents were able to fast during Ramadan without difficulties. Many believed that fasting could improve general well-being. Most of them never experienced hypoglycaemia while fasting, but were aware of the symptoms and management of hypoglycaemia. Most respondents did not adjust their medications during fasting and reported either unchanged or reduced dietary intake. Only a few respondents owned glucometer and monitored blood glucose routinely although most respondents acknowledged the benefits of SMBG. Majority agreed that cost and logistic issues were the main barriers in practicing SMBG.

Conclusion: Generally, T2DM patients were positive about fasting. Nevertheless, these patients may not adjust their antidiabetic medications and monitor their blood sugar routinely during Ramadan although they were aware of the importance.

Keywords: perception, behaviour, Type 2 Diabetes Mellitus, diabetes management, Ramadan

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Introduction

Fasting during the holy month of Ramadan is one of the five pillars of Islam. Healthy Muslims are required to refrain from eating, drinking, smoking, using oral medications, sexual intercourse and other actions that should be abstained throughout the day, from sunrise until sunset. There are exemptions for those who are in a condition which does not allow them to fast, however, especially if fasting could worsen their health. These include pregnancy and nursing mothers, patients with uncontrolled chronic illnesses, elderlies and weak persons. For patients with uncontrolled diabetes, fasting during Ramadan has been consistently discouraged by healthcare providers as their risk of complications such as hypoglycaemia, hyperglycaemia, diabetic ketoacidosis, dehydration and thrombosis are high (1).

Fasting does not intend to create excessive hardship on the Muslims since individuals with conditions that do not allow them to fast are exempted. Nevertheless, many diabetic patients still insist on fasting and this could be challenging for themselves and the healthcare providers. In the Epidemiology of Diabetes and Ramadan (EPIDIAR) study which was conducted in 13 Islamic countries, high rate of acute complications was observed among the 12,243 diabetic individuals who fasted (2). Most of the patients

practice Ramadan fasting under the pressure of socio-cultural habits despite their doctors' disapproval (3) and healthcare professionals are rarely included in the decision-making process on whether or not to fast. Instead, friends and relatives, especially those with Type 2 Diabetes Mellitus (T2DM), are considered important to the decision-making process (4). These highlighted the difficulties to manage these patients.

A few guidelines and recommendations were published to guide patients with diabetes in managing their medications while fasting during Ramadan. In CREED study, almost all physicians reported providing fasting-specific advices to the patients and most of them reported using guidelines or recommendations for the management of diabetes during Ramadan (5). A patient's decision to fast should be made after ample discussions with a healthcare provider concerning the risks involved (6). For successful Ramadan fasting, attention must be paid to meal planning, glucose monitoring, daily activities and treatment adjustment (6,7). Thus, healthcare providers should play a pivotal role in giving advices and guiding these patients in adjusting to their temporary medications regimen changes during fasting in Ramadan.

There are multiple guidelines to aid healthcare providers in managing diabetic patients during Ramadan. However, limited data is available in Malaysia regarding the perception and behaviour of diabetic patients during the fasting month. Identification of the patients' experience and knowledge on diabetes management is important to aid healthcare providers to provide better care for diabetic patients (8). Therefore, this study aimed to explore the perception and behaviour of Muslim patients with T2DM in Hospital Tuanku Ampuan Najihah (HTAN) towards diabetes management during Ramadan. Findings from this study could provide a better understanding on the views and behaviours of T2DM patients thus improving patient care to ensure safe fasting.

Methods

This was a qualitative study aiming to comprehend from participants' own statements, what they believe concerning diabetes management and to explore how they behave towards handling their medications during Ramadan. Purposive sampling method was used. Muslim patients with T2DM aged 18 years old and above who were on at least one antidiabetic agent, fasting or not fasting during Ramadan, followed up at Medical Outpatient Department (MOPD) of HTAN for at least one year, and understood either Malay or English language were included in the study. Patients who were unable to comprehend the interview questions were excluded from the study.

Ethical approval (NMRR-18-3150-42652) was acquired from the Ministry of Health Malaysia Medical Review and Ethics Committee (MREC) prior to the commencement of the study. The investigators also obtained site approval prior to the initiation of the study. The participant's involvement in this study was on a voluntary basis and they were informed that they could quit the interview at any stage. Informed consent was obtained from all participants before the interview.

Data collection was conducted from August to October 2018 through face to face in-depth interview using an open-ended semi structured guide. The semi-structured interview guide was developed based on literature review and validated via peer review process. It explored a range of perceptions on fasting, diabetes management, diet control and self-monitoring blood glucose (SMBG) practice. A pilot study was conducted to pre-test the interview guide but the data was not included in the final analysis.

The interviews were conducted in a place where both the researcher and respondents considered as suitable and comfortable. The purpose of the study was explained to all respondents and they were informed that the interview sessions were audio recorded. Each session was held around 20 to 30 minutes. The respondents could freely answer any questions that they wanted to. General probing questions such as "Can you explain further?", "What is your opinion on this?" and "Can you further clarify?" were used during the interview sessions to facilitate the answering. The interviews were conducted in either Malay or English, which both researcher and participant can clearly understand each other.

All the interviews were audio recorded and transcribed verbatim by the primary investigator to avoid bias. Field notes taken during the interviews were compared to the transcripts. Each transcript was then repeatedly read by two other researchers. The main words and topics for each interview were highlighted and coded and these codes were identified and compiled into themes. Peer-reviewed translation of the quotes of the local Malaysian language interviews was conducted to make sure that the concepts were translated correctly. Commonalities and differences in the data were identified before the relationship between the data was made, and descriptive and explanatory conclusions were drawn (9,10). Data collection was discontinued when saturation was achieved, where no new information was obtained from subsequent interviews.

Results

A total of thirty T2DM patients were interviewed (Participant 1 to Participant 30). The respondents were equally distributed between males and females. Majority of the participants aged 50 and above (83.3%) and with monthly income below RM3,000 (90%). Most of the participants have a diabetes duration of 10 years and below (66.7%). More than half of the participants are insulin users (56.7%) and most of the participants do not own a glucometer at home (66.7%). The demographic and clinical characteristics of the respondents were summarised in Table 1.

The thematic content analysis identified four major themes and fourteen sub-themes as illustrated in Table 2. The four main themes identified in this study were perception of fasting, diabetes management, diet control and self-monitoring blood glucose (SMBG).

Table 1: Demographic and clinical characteristics of participants (n=30)

Characteristics	n (%)
Age range, year	
20 – 29	1 (3.33)
30 – 39	0 (0)
40 – 49	4 (13.33)
50 – 59	10 (33.33)
60 – 69	14 (46.67)
70 – 79	1 (3.33)
Gender	
Male	15 (50.00)
Female	15 (50.00)
Body Mass Index (BMI), kg/m^2	
18.5 – 24.9	9 (30.00)
25 – 29.9	11 (36.67)
Above 30	10 (33.33)
Educational Status	
Primary	12 (40.00)
Secondary	14 (46.67)
Certificate	2 (6.67)
No Formal Education	2 (6.67)
Working Status	
Working	16 (53.33)
Not Working	14 (46.67)
Monthly Income	
< RM999	3 (10.00)
RM1,000 – RM1,999	16 (53.33)
RM2,000 – RM2,999	8 (26.67)
RM3,000 – RM3,999	1 (3.33)
RM4,000 – RM4,999	1 (3.33)
RM5,000 – RM5,999	1 (3.33)
Duration of Diabetes, year	
1 – 5	13 (43.33)
6 – 10	7 (23.33)
11 – 15	5 (16.67)
16 – 20	1 (3.33)
21 – 25	4 (13.33)
Antidiabetic Agents	
Oral Anti-Diabetic Agents (OAD)	13 (43.33)
Insulin	10 (33.33)
OAD and Insulin	7 (23.33)
Own a Glucometer	
Yes	10 (33.33)
No	20 (66.67)

Table 2: Themes and sub-themes

Theme	Sub-theme
Perception of fasting	Ability to fast
	Knowledge on risk of fasting
	Issues with fasting
	Significance of fasting
Diabetes management	Behaviour during Ramadan
	Management of Hypoglycaemia
	Source of information
	Adjustment of medications
Diet control	Challenges in controlling diet
	Changes in eating habit
Self-Monitoring Blood Glucose (SMBG)	Practicing SMBG
	Benefits of SMBG
	Barriers in practicing SMBG

Theme 1: Perception of fasting

Sub-theme 1.1: Ability to fast

In this study, majority of the interviewed patients (n=22) were able to fast during Ramadan without any difficulties.

> *"I do not have any problem with fasting even though I have diabetes. Fasting is full." (Participant 13)*

Participants did not experience any symptoms of hypoglycaemia even though they have diabetes for more than 5 years. Moreover, they confidently claimed that they could perform fasting during Ramadan since the first year they had been diagnosed with diabetes.

> *"It's full (fast for whole Ramadan month). Last time more difficult but I can survive. Even though I have diabetes, it is not a problem." (Participant 24)*

Nevertheless, eight participants mentioned that they were unable to fully fast during Ramadan, but they still performed fasting for certain days during Ramadan.

> *"If I feel the signs of hypo (hypoglycaemia) ... About 5 days if I'm not mistaken ... I only fast for 25 days." (Participant 8)*

Sub-theme 1.2 Knowledge on risk of fasting

Thirteen participants claimed that they knew the risk of fasting with diabetes. The most common risks reported were hypoglycaemia accompanied by lethargy, tremor, sweating and dizziness.

> *"The risk is the lack of sugar in the body. That's all. I'm afraid of hypo. That's what the doctor told me. Another symptom that I told you is tired. Less energy. That's what I experienced during the fasting month." (Participant 9)*

Meanwhile, nine participants mentioned they did not know the risk of fasting and no one had ever told them about the risk of fasting. Some of the participants did not experience any difficulties during fasting thus they were unable to list out the risk of fasting.

> *"Ha. I do not know the risks... No one had ever told me what to do (if I get the risk of fasting)." (Participant 4)*

> *"I'm not sure because I have no experience (of getting the risk during fasting month). Even though I have diabetes for so long, during fasting month, there is no problem." (Participant 29)*

Sub-theme 1.3 Issues with fasting

Only seven participants had some issues with fasting. Some of them were confused on the timing of taking medications, while some of them tend to forget their medications due to the different routines during Ramadan.

> *"I'm a bit confused about taking the medications. Because some you need to take after breaking the fast and some to take after sahur. So it's a little bit confusing ..." (Participant 3)*

> *"During fasting month, it is hard to be compliant. Sometimes I'm not injecting insulin during the day because I tend to forget. During non-fasting month, it's easy as I remember to inject the insulin before I eat. While at night, sometimes I forgot to inject the insulin because I went to sleep earlier (in Ramadan)." (Participant 19)*

More than half of the participants (n=17) did not have any major issues with fasting. They experienced a few conditions such as hunger or thirst, but they were still able to manage the situation.

> *"For me there is no problem at all. It's normal to feel hungry during fasting month. But not to say until I am too weak (to continue fasting)." (Participant 15)*

> *"It is normal to feel hungry since I'm fasting. I did not experience any change (in my body) during fasting month." (Participant 27)*

Sub-theme 1.4 Significance of Fasting

Many (n=21) believed fasting can improve general well-being. Their body felt lighter, healthier and they could reduce weight through fasting.

> *"It's alright to fast. Because we have diabetes so everything must be controlled. Food, sugar, water. (Take care of) Our bodies, kidney. So, it is good if we fast." (Participant 1)*

> *"My body becomes healthier. Feel fresh while I'm fasting." (Participant 18)*

Two participants believed that they could gain *pahala* (reward) by following Islamic teaching.

> *"I will be rewarded. I can control my dietary intake especially sugar during the day. I can cleanse my stomach too (if I perform fasting)." (Participant 17)*

Theme 2: Diabetes management

Sub-theme 2.1 Behaviour during Ramadan

Slightly more than half of the participants (n=16) knew how to control their diet and how to manage their daily routines while fasting. Some believed that their behaviour might affect their fasting status during Ramadan.

> *"When start getting hypo (hypoglycaemia), we will feel shaking, sweating and going to faint. I'll quickly take sweet drinks and break the fast." (Participant 1)*

> *"I know what to do. Must control diet, take medications, inject insulin." (Participant 16)*

> *"We have to control our diet even though we can't eat during the day, but we must control food intake while breaking the fast. I only eat oat during Sahur and dates as usual." (Participant 20)*

Four participants did not aware their behaviour might affect their management of diabetes during fasting.

> *"…No idea. I've no experience." (Participant 25)*

Sub-theme 2.2 Management of hypoglycaemia

Most of the participants (n=22) had never experienced hypoglycaemia while fasting, whereas five participants had some episodes of hypoglycaemia during Ramadan. However, both groups were aware of hypoglycaemia symptoms and management of hypoglycaemia.

> *"If blood glucose level is below 4, I will break the fast. But sometimes, if time is nearly to breaking the fast at evening, I will wait until the time of breaking fast. I always ask myself whether I can fast or not, is there any problem. If no problem, I will continue fasting." (Participant 11)*

"If symptoms of hypoglycaemia appear, must take sugar. But for me, I had never experienced hypo so far." (Participant 12)

"There is no problem when fasting. I am already old and get used to fasting during Ramadan. If hypo, just break the fast will do." (Participant 28)

Sub-theme 2.3 Source of information

Half of the participants (n=15) gained the information from healthcare providers such as pharmacist, doctor, nurse, or medical assistant, while some participants (n=3) acquired the information from pamphlet.

"Pharmacist always provides the information regarding this matter." (Participant 22)

"I got a pamphlet from pharmacy, it contains information on how to take medication during fasting month." (Participant 23)

Only three participants claimed they never received any information regarding how to manage diabetes during Ramadan.

"No. Doctor never teach me, I do it by myself." (Participant 3)

Sub-theme 2.4 Adjustment of medications

More than half of the participants (n=18) did not adjust their medications during Ramadan. Some agreed that the doses of their medications were adequate during Ramadan, while some dare not adjust by themselves.

"I didn't change the dose (of my insulin). My (insulin) dose only little. My body also okay." (Participant 16)

"I do not dare to change the units (of insulin). I'm afraid not enough (dose) or over inject." (Participant 25)

Only seven participants adjusted their diabetic medications during Ramadan. Some of them did as instructed by the healthcare providers, while some adjusted the medications by their own based on their body condition.

"Let's say if usually we inject 30 (units of insulin) and 26 (units of insulin). You revert it (dose of insulin) when fasting. Morning can reduce a bit (dose) some more. Doctor told me to do so." (Participant 1)

"Yes. I increased 2 units before going for Raya feast. It's up to us how to adjust it." (Participant 10)

Theme 3: Diet control

Sub-theme 3.1 Challenges in controlling diet

Half of the participants (n=15) claimed that they had no problem in adjusting their diet during Ramadan since they were used to fast. There was not much difference in terms of food intake during fasting and non-fasting month.

"Nothing. Maybe I already get used to it. Whether fasting or not, it's the same. I don't feel hypo, dizzy, hungry, tired or anything." (Participant 4)

"For me is not a problem. We should know the risk (of not controlling diet) ourselves. We cannot eat extra. Same only (amount of food intake) fasting or not fasting." (Participant 5)

Some of the participants (n=5) agreed that there were challenges in controlling their diet during fasting, but they knew they must not have excessive food intake to ensure good glycaemic control. Two participants mentioned that the most challenging part was to resist their craving for food when they visited *Bazaar Ramadan* (local food market specially operating during Ramadan).

"It's hard to control what we eat. But since it is fasting month, we are forced not to eat during the day. Challenging but you have to accept it." (Participant 20)

Sub-theme 3.2 Changes in eating habit

Less than half of the participants (n=10) claimed that there were no changes in their eating habits. The amount of food intake was similar during fasting and non-fasting month.

> *"During non-fasting month, I did not eat much. I usually eat the same amount every day. I only eat half plate of rice. So as usual ... I only eat a little." (Participant 3)*

> *"Dietary intake is similar as always. Nothing changes." (Participant 7)*

Meanwhile, some of the participants admitted that there were changes in their food intake during the fasting month. They were able to reduce sugar intake, as in overall the amount of food intake is reduced during Ramadan.

> *"Reduce in dietary intake during fasting month. I only eat a little at night." (Participant 29)*

Theme 4: Self-monitoring blood glucose (SMBG)

Sub-theme 4.1 Practicing SMBG

One third of the participants (n=10) kept a glucometer at home. Among them, only eight participants performed blood glucose checking at home, while the other two participants claimed not checking blood glucose for a period of time because of financial constraint.

> *"I do it (SMBG) twice to three times daily ... If it's a fasting month, I check before sahur and before breaking the fast in the evening." (Participant 2)*

> *"I have a machine (glucometer) at home. Check 4 or 5 times a week. If I feel weak I will check too." (Participant 20)*

A few participants (n=5) carried out random blood glucose monitoring at health clinics or community pharmacy, based on symptoms and their body conditions.

> *"I check at health clinic once a week. Doctor asked me to go. (The clinic is) Near Palong." (Participant 6)*

Some of the participants (n=5) believed that examination during clinic appointment with doctor was adequate, thus further blood glucose monitoring was not required.

> *"I rarely go for blood sugar checking. Usually I check it when I have an appointment." (Participant 15)*

Sub-theme 4.2 Benefits of SMBG

More than half of the participants (n=18) believed they could benefit from SMBG practice. By monitoring own blood sugar, they could adjust the dose of insulin or amount of carbohydrate intake based on the blood glucose level. It also helped them to decide whether to continue fasting or to break the fast.

> *"First I can know how much of sugar (level) in my body is now. Second, I can know how many (insulin) to inject. For example, if high, add 2 units (of insulin)." (Participant 8)*

> *"If below 4 (blood glucose level) I'll break the fast because I'm scared of hypo, but if I feel hot, hunger, thirst, then I'll check the reflo (blood glucose level). If the level is high, I'll inject Actrapid." (Participant 11)*

> *"I can know the blood sugar level in the body. If the sugar is high, I'll control dietary intake, and take less sugar." (Participant 12)*

Sub-theme 4.3 Barriers in practicing SMBG

Cost and logistic issues were two main barriers to practicing SMBG among the participants (n=16). In addition, some participants who stayed in rural area and could not afford a glucometer need to travel a distance to the nearest health clinic or community pharmacy to check their blood sugar level, thus routine blood sugar monitoring was not feasible.

> *"Yes. Sometimes it's a problem to buy (test strips). Because I only have two children. Both are working, and I stay with my husband. If it (test strips) almost finish, I'll let them know earlier. It's*

difficult to buy, because it is not sold at the clinic, can only buy (the glucose test strips) from the pharmacy and the pharmacy is far, it's at Bahau." (Participant 2)

"No money. The needle (lancet) is expensive, the paper (test strip) also expensive. Sometimes I do it every week, sometimes not, it depends (on my financial status)." (Participant 13)

Some found that SMBG was time-consuming and difficult to perform on their own at home.

"Expensive. And I'm old, don't know how to do it by myself." (Participant 27)

One participant mentioned that it was difficult to buy the glucose strip for the brand of glucometer that he was using, thus limiting his practice of SMBG.

"The problem is very difficult to find the strip. Sometimes the brand is not available anymore." (Participant 12)

Only two participants did not have any issues in practicing SMBG.

"No. There is no obstacle. The clinic is near to my house and Alpro (pharmacy) also is not that far." (Participant 5)

Discussion

Previous studies reported that there were significant numbers of patients who did not consult a health professional prior to Ramadan fasting and some even fasted against medical advice, leading to unpleasure experiences during the Ramadan (2-4,11,12). The decision to fast might be influenced by family pressures and the overall social aspects of fasting (4,13). This study explores the perception and behaviour of T2DM patients towards diabetes management during the Ramadan. Understanding from the aspect of patients is extremely important, as this information could assist healthcare providers to structure their care plan according to patient's perspective of view, subsequently providing a more comprehensive care to ensure safe fasting.

The most common risks of fasting among diabetic patients are hypoglycaemia, hyperglycaemia and dehydration (1). It is therefore very important for patients to have the basic knowledge of diabetes to enable better self-management of diabetes during Ramadan. The EPIDIAR study showed that during the Ramadan, the risk of severe hypoglycaemia increased by 7.5 folds (0.4 to 3 events per 100 month) while causing a five-fold increase in the incidence of severe hyperglycaemia in T2DM patients. One of the main reasons was due to the lack of knowledge in managing diabetes during Ramadan (2).

The recent DAR 2020 Global Survey observed a high rate of Ramadan fasting regardless of fasting risk level (14). Although less than half of the participants in this study knew the risk of fasting, majority of them were able to fully fast throughout the Ramadan. This showed that Malaysia Muslims have a strong will in fasting. This finding is similar to a study by Salti *et al.*, in which the proportion of subjects fasting for at least 15 days is highest in Malaysia (89.8%) among the 13 countries studied (2). Although some of the participants were experiencing some issues such as thirst and hunger, they still continued to fast in view of their past experiences of fasting for years. Most of the participants chose to fast because they believed that fasting could help improving their general well-being. This was similar to another study by Lee *et al.*, where participants reported optimism towards fasting because they believed that fasting is beneficial to their overall well-being and family bonding (15). Some of our participants believed in the *pahala* (reward) and Allah gives them the willpower to abstain from food and drinks.

In order to minimise the adverse effects during fasting among diabetic patients and to maintain good glycaemic control, patient education and discussion of glucose monitoring and treatment regimens with their healthcare provider shall occur several weeks prior to Ramadan (16). Ramadan-focused education in diabetes empowers the patients to change their lifestyle during Ramadan, thus minimising the risk of hypoglycaemic events and preventing weight gains, which potentially benefits metabolic control (17). In this study, only half of participants claimed that they obtained right information from their healthcare providers prior to Ramadan and some of the participants acquired the information through pamphlet. Most of the participants in this study were educated with only two did not receive any formal education. Hence, this may explain why majority of the participants in this study had the knowledge on management of hypoglycaemia during Ramadan and did not experience any symptoms of hypoglycaemia while fasting.

A significant improvement in HbA1c was observed in patients who had adjustments made to their doses of antidiabetic agents during the Ramadan (18). However, there were only a few of our respondents

who adjusted the doses of insulin during fasting although most of them received relevant information from their healthcare providers. This was probably because the information provided focused more on non-pharmacological management. According to Beshyah *et al.*, physicians demonstrated inconsistencies in their level of knowledge, attitude and practices about the care of patients with diabetes during Ramadan (19). Therefore, it was recommended that simplified guidelines and educational materials could be dispensed to healthcare providers before Ramadan (20). To ensure that the patients are well equipped with the knowledge in pharmacological management, all diabetic patients should discuss with their healthcare providers regarding the need to change their medication regimen before Ramadan. This is especially true for all insulin users, as they should know how to adjust their insulin accordingly as most of the insulin regimes require adjustment according to the change of meal pattern in Ramadan.

Major changes in the dietary habits, daily physical activities and sleeping patterns during Ramadan have significant impact on glycaemic control, lipid profile, weight and dietary intake (21). In a study by Trepanowski and Bloomer in 2010, dietary changes pertaining to calorie intake may or may not differ over the period of Ramadan. These differences were responsible for the discrepancies in health-related outcome. Hence, whether or not Ramadan fasting elicits favourable health outcomes, it depends on the food choices of the fasters (22).

Lacking of food and water intake during the day along with heavy meals before and after fasting could create serious health issues as the routine diet pattern is disrupted. Most of the participants in this study seemed to understand this concept and thus reported an unchanged dietary intake, while less than half of the participants reported a reduction in dietary intake and there was no report of increased dietary intake. Majority of the participants in this study were more than 50 years old, thus they could have relatively poor appetite. Pilgrim *et al*. in 2015 found that many older people experience decreased appetite due to many factors including changes in physiological function, social circumstances, acute illness, chronic disease and use of medications (23).

SMBG is an important component of modern therapy for Diabetes Mellitus in order to achieve the targeted glycaemic control and to prevent hypoglycaemia (24-26). More detailed information on blood glucose level can be obtained by practicing SMBG. This information can help in the adjustment of a therapeutic regimen, modifying dietary intake and insulin dose on a regular basis (24). Most of the participants in this study also agreed that via SMBG, they could monitor their blood glucose level well during fasting month. SMBG can assist them in insulin adjustment, help them in making decision when to break the fast, and to modify their carbohydrate intake. A prospective study by Ahmedani *et al.* observed that with active glucose monitoring, alteration of drug dosage and timing, dietary counselling and patient education, majority of the patients did not have any serious acute complications during the Ramadan (27).

Although most of the participants in this study understood the benefits of SMBG practice, only a few of them owned a glucometer and performed SMBG routinely. The others only did random blood glucose checking when they felt unwell or during appointment with doctor. Cost was identified as the main barrier to SMBG in this study. As most of the participants in this study had low income (less than RM2,000 per month), they might not afford to buy the test strips and monitored blood sugar regularly. Considerable gaps persisted between the actual and recommended SMBG practices. Patients paying higher out-of-pocket expenditures for test strips were reported to have lower frequency of SMBG, which suggested that removing the financial barriers may probably increase the practice SMBG (28). Logistic issue was another common barrier to routine monitoring of blood glucose. Some of the participants stay in rural area, thus accessibility to nearest healthcare facilities or community pharmacy for blood glucose checking was an issue. Besides, the availability of glucose test strips was another obstacle in practicing SMBG. There were many brands of glucometers and glucose test strips available in the market. Whether or not a retail pharmacy keeps certain brands of glucose test strips was another factor in affecting SMBG practice.

By understanding patients' perception and behaviour during Ramadan, healthcare providers can optimise pre-Ramadan interventions to ensure safe fasting. Services can be expanded to incorporate other healthcare practitioners such as pharmacists, dieticians and nurses in giving advices on lifestyle modification, medication adjustment and active glucose monitoring during Ramadan. The main limitation of the study was that participants' responses were not correlated to clinical variables such as HbA1c and blood glucose readings. Future studies can focus on behavioural relationship with clinical variables to cater more insightful findings.

Conclusion

This study found that Muslim diabetic patients could be optimistic about Ramadan fasting as they believed that fasting can help to improve their general well-being. The patients, however, may not adjust their antidiabetic medications during the Ramadan. SMBG may not be widely practiced by the patients due to cost and logistic factors although they may be well aware of its importance. Therefore, healthcare providers should play a more active role in providing proper and adequate information to diabetic patients who wish to fast during Ramadan, with emphasis on the importance of medication adjustment and blood glucose monitoring. SMBG practice should be encouraged in all diabetic patients especially those on medications. This study outcome can assist healthcare providers to know better about patient's perspective of view, hence providing more comprehensive care to ensure safe fasting during Ramadan.

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Conflict of Interest

The authors declare that they have no competing interests.

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