

ORIGINAL ARTICLE

Knowledge, Attitude, and Practice about Fasting in Ramadan among Diabetic Patients

MALEEHA IQBAL¹, RASHID AHMAD², SHAMA IQBAL³, SHAMAILA ZAHID⁴, SAJID ALI⁵¹Senior Lecturer, Islamic & Pakistan Studies Department, Peshawar Medical College, Warsak Road, Peshawar. Riphah International University, Islamabad, Pakistan.²Senior Medical Officer, Khyber Teaching Hospital, Peshawar, Pakistan.³Woman Medical Officer, City Hospital, Peshawar, Pakistan.⁴PhD scholar, Institute of Basic Medical Sciences, Khyber Medical University, Peshawar, Pakistan.⁵Associate Professor, Department of Biotechnology, Abdul Wali Khan University, Mardan, Pakistan.Correspondence to: Sajid Ali, Email: sajid@awkum.edu.pk

ABSTRACT

Background: Every year, Muslims fast from dawn to dusk in the Holy month of Ramadan. Mostly, patients with diabetes are unaware of the complications related to fasting including hypoglycemia and dehydration. This study aimed to determine the socio-demographic data of diabetic patients and knowledge, attitude, and practices of diabetic patients toward Ramadan fasting in Peshawar, Khyber Pakhtunkhwa, Pakistan.**Materials and Methods:** This descriptive cross-sectional study was conducted in tertiary care hospital, Peshawar. A total of 180 diabetic patients have participated in the study. All patients were Muslim-diagnosed diabetic patients irrespective of age, gender, ethnicity, and type of diabetes. Structural self-designed questionnaire related to diabetes and associated information. Questions were asked after taking the consent form from all participants. The questionnaire was related to education, doses timing, glucose monitoring, eating habits, and physical activities.**Results:** Among a total of 180 diabetic patients, 53.9% were male and 46.1% were female diabetic patients. The minimum age was 15 years and the maximum age was 88 with a mean age of 52.7+14.5 years. The highest number of diabetic patients were identified in the age-group 46-55 years with 26.3%. Diabetic patients were more found illiterate (49.4%) as compared to educated. Type II diabetes mellitus was found in 92.8% of patients.**Conclusion:** The findings of the present study revealed that knowledge and practice of diabetic patients during fasting in Ramadan is less. Ramadan health education and training in diabetic patients can improve and guide patients to ensure safe and risk-free fasting.**Keywords:** Diabetes, Ramadan, Fasting, Knowledge, Attitude, Practices

INTRODUCTION

Diabetes mellitus is a condition in which insulin production is impaired or does not respond properly, resulting in elevated blood glucose levels. Polyuria, thirst (polydipsia), and unintentional weight loss are all common diabetes symptoms¹. Heart attack, headache, stroke, poor wound healing, diabetes foot, neuropathy, and nephropathy are all complications associated with diabetes². Blood sugar tests, such as random or fasting blood sugar, are used to diagnose diabetes. Diets low in carbohydrates, saturated fats, and processed foods are advised. Exercise and medication are commonly used to lower and control blood sugar levels³.

The autoimmune destruction of pancreatic islets of Langerhans cells is a common cause of type I diabetes. Antibodies to the Langerhans islets have been found in the blood of type I diabetics. Type I diabetes affects both the mother and the father in about 2-5 percent of children⁴. Type 2 diabetes mellitus (T2DM) is the most common non-communicable disease worldwide. The prevalence of T2DM is steadily rising, especially in developing countries. Obesity, a sedentary lifestyle, and poor eating habits are all common contributing factors to T2DM in the young population⁵.

In Pakistan, type 2 diabetes mellitus affects 11.8 percent of the population. Males were more affected than females when it came to gender differences. In Sindh, Punjab, Baluchistan, and Khyber Pakhtunkhwa, the prevalence of type 2 diabetes was around 13 percent, 11 percent, 11 percent, and 10 percent, respectively⁶.

Diabetes is also common among pregnant women, accounting for about 4% of all cases. Lack of insulin or hormones released by the placenta is a common cause. High sugar levels in the mother can affect the sugar levels in the infant, resulting in growth and developmental issues⁷. Globally, the number of people diagnosed with diabetes has risen to 451 million people aged 18 to 99. According to current trends, the number of diabetic patients will reach 693 million by 2045⁸.

According to a recent study, 93 percent of Muslims fast during Ramadan (3 months)⁹. Fasting during Ramadan is one of Islam's pillars, and it is observed by the majority of Muslims during the ninth month of the Islamic calendar. Except for those who are traveling or sick, all adult Muslims must fast from dawn to dusk¹⁰. Although

high-risk people are exempt from fastings, such as diabetic patients, people who are traveling, people who are sick, and people who are at risk of serious health problems¹¹, most people insist on fasting because it is part of their culture and religion. The length of a fast varies greatly depending on the season and location⁹. The eating and sleeping habits of Muslims changed during Ramadan. Predawn and sunset meals are traditionally different from regular meals, with rich sources of carbohydrate and high glycemic indexes being used frequently. During these days, people consume larger than usual portions of meals, especially during the fasting period¹¹.

Ramadan is still a major concern for diabetic patients all over the world⁹. As a result, it is critical to provide diabetic patients with information about food and medication during Ramadan. Failure to provide proper care to diabetic patients could have serious consequences. In the month of Ramadan, the Diabetes and Ramadan International Alliance (DAR) prepared instructions for diabetic patients, which were distributed to clinicians¹². The risk assessment, medication adjustments, dietary plan, and self-management were all included in the guidelines. Self-management actions to achieve an optimal glucose level require both pre-Ramadan changes and patient education¹³. Due to an increased risk of dehydration, hypoglycemia, and hyperglycemia¹⁴, Ramadan fasting is more difficult during the summer and for long periods (up to 16 hours)¹¹.

It is critical to determine diabetic patients' knowledge, attitude, and practice of Ramadan to develop effective management plans and reduce complications associated with fasting during the month of Ramadan. The goal of this study was to look at diabetic patients in the Peshawar region of Pakistan's Khyber Pakhtunkhwa province's knowledge, attitude, and practice of Ramadan.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted in Peshawar's tertiary care hospital's medical wards and outdoor patients. Following institutional review board approval (IRB), a total of 180 diabetic patients (sample size determined at 90% confidence interval using the WHO calculator) were included. The current study included all diagnosed diabetic Muslims, regardless of

their age, gender, ethnicity, or type of diabetes. Non-Muslim patients who were unable to respond to questions due to physical or psychological issues were excluded from the group. Diabetic patients volunteered to participate, and after explaining the study's purpose and objectives, all patients gave their informed consent.

According to the design study principal goals, a structured self-administered questionnaire was prepared. The following data was gathered using a questionnaire: demographics, physical activity, glucose monitoring, eating habits, medication administration timing, and type of diabetes.

The surveys collected socio-demographic data, as well as diabetes patients' knowledge, attitudes, and practices regarding fasting during Ramadan. Age, health education, educational attainment, and gender are all socio-demographic factors.

A total of twenty-one questions were asked about diabetes knowledge, attitude, and practice. The questions focused on fasting permission in Islam, insulin use during fasting, physician consultation about critical sugar levels, diabetic pregnant women, baby feeding, breaking of the fast after observing hypoglycemic patients, physical activities, Taraweeh, sugar testing during fasting, medication timing, sugar monitoring, and fasting training during Ramadan. There were two options for answering each question: "Yes" or "No."

All of the information was gathered from patients using a written questionnaire and individual interviews. Microsoft Excel 2007 and Statistical Package for Social Sciences version 22 were used to enter the data. The descriptive data were computed, and the significance of the findings was determined. For better data presentation, mean and standard deviation tables, as well as frequency tables, were created.

RESULTS

Patients with diabetes were recruited for this study, and they were divided into age groups and gender groups. A total of 180 diabetic patients were enrolled in the study, with 97 men and 83 women accounting for 53.9 percent and 46.1 percent of the total. According to age-specific distributions, the age group 46-55 years had the highest percentage of diabetic patients (26.3%), followed by age group 36-45 years (20.1%), age group 56-65 years (18.9%), age group >65 years (16.8%), 26-35 years (13.9%), and 15-25 years (13.9%). (4.1 percent). Three female diabetic patients and five male diabetic patients in the 15-25 year age group were included in the total.

There were twenty-five (25) diabetic patients in the age group 26-35 years, with nine (09) females and sixteen (16) males. There were 36 diabetic patients in the 36-45 year age group, 15 females and 21 males. There were 47 diabetic patients ranging in age from 46 to 55 years old (27 females and 20 males). There were a total of thirty-four (34) diabetic patients in the age group of 56-65 years (14 female and 20 males). A total of thirty (30) patients over the age of 65 were recruited, with 15 females and 15 males. The average age was 52.70+14.5 years, with a minimum of 15 and a maximum of 88. (Table 1).

Table 1: Distribution of diabetic patients according to age and gender.

Age (Years)	Female n (%)	Male n (%)	Total n (%)
15-25	03	05	08 (4.1)
26-35	09	16	25 (13.9)
36-45	15	21	36 (20.1)
46-55	27	20	47 (26.2)
56-65	14	20	34 (18.9)
>65	15	15	30 (16.8)
Total	83 (46.1)	97 (53.9)	180 (100)

The patients were divided into four groups based on their level of education: illiterate, primary school, secondary school, and higher school. The numbers of illiterate patients were 49.4% (n=89), primary level was five percent (n=09), secondary was 3.9% (n=07) and patients with higher education was 41.7% (n=75). The patients with the highest percentage of illiteracy, 49.4 percent, were followed

by those with higher education, 75 patients, for a percentage of 41.7 percent (Table 2).

Table 2: Distribution of diabetic patients based on education level.

Literacy Level	Frequency (n)	Percentage (%)
Illiterate	89	49.4
Primary School	09	5.0
Secondary School	07	3.9
Higher School	75	41.7
Total	180	100

The patients were divided into two groups based on the type of diabetes they had: type I diabetes and type II diabetes. Type I diabetes affected 13 people, accounting for 7.2 percent of the total, while type II diabetes affected 167 people, accounting for 92.8%. Type II diabetes was found to be more common than type I diabetes in this study (Table 3).

Table 3: Diabetic patients are distributed based on the type of diabetes (Type I and Type II).

Type of Diabetes	Frequency (n)	Percentage (%)
Diabetes Type I	13	7.2
Diabetes Type II	167	92.8
Total	180	100

Table 4 of the results section lists some other general characteristics of the patients based on the questionnaire, such as their medications, exercise, fasting and taking suhoor (Sehri), insulin injection use, blood glucose monitoring, and so on. A questionnaire with various questions about the relationship between fasting and diabetes is shown. Approximately 73.9 percent of people believe that Muslims do not require diabetic patients to fast. Approximately 53.6 percent of people were opposed to fasting injections, while 46.4 percent were in favor of fasting injections. In total, 86.7 percent of diabetic patients believe that Sehri cannot be skipped, while 13% believe that sehri can be skipped by diabetic patients. Overall, 75.5 percent of diabetic patients were in favor of breaking their fast and seeking medical advice, while 24.5 percent were against it. About 55 percent of diabetic patients agreed that taking insulin injections during fasting is permissible in Islam, while 45 percent disagreed. In total, 21.7 percent of diabetic patients supported fasting for pregnant women, while 78.3 percent opposed it. In total, 34.4 percent of patients were in favor of breastfeeding mothers fasting, while 65.6 percent were against it. Adolescents with brittle type I diabetes responded "yes" 71.1 percent of the time, while diabetic patients responded "no" 28.9% of the time.

In hypoglycemia, 73.3 percent of diabetic patients were more likely to break their fast. Approximately 85.6 percent of diabetic patients were opposed to continuing exercise and extreme physical activities, while 14.4% were in favor of exercising while fasting. Overall, 59.4% of diabetic patients thought Tarawih prayer was a good alternative to exercise during Ramadan, while 40.6 percent were opposed. 53.9 percent of diabetic patients said eating more food during sehri was beneficial, while 46.1 percent said it was harmful. Needle pricks were disliked by 59.4 percent of diabetic patients when testing blood sugar in fasting conditions. In the current study, 76.7 percent of participants believed that taking medication during Aftar time is a better option during Ramadan, while 23.3 percent disagreed. Overall, 81.7 percent of diabetic patients agreed that drug dosage and timing should be adjusted. Aalim (religious scholar) is a more suitable person to know and advise diabetic patients regarding Ramadan fasting, according to 55 percent of participants. In total, 43.3 percent of patients were in favor of blood sugar monitoring during Ramadan, while the remaining 56.7 percent were against it. In total, 65.2 percent of the patients were aware of injecting insulin, while the remaining 34.8 percent were unaware. About 45 percent of patients were undergoing an Islamic medical training course called fasting in Ramadan, while the other 55 percent were unaware of the training. In total, 45 percent of diabetic patients believed that fasting during Ramadan deteriorated glycemic control, while the majority disagreed.

Table 4: Baseline characteristics of participants (Diabetic patients) and their relationship with fasting in the Holy month of Ramadan.

Characteristics of participants	Yes		No	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Does Islam permit patients with diabetes or fast?	132	73.3	48	26.7
Does taking insulin injection during fasting breaks the fast?	83	46.1	97	53.9
Can sehri (Suhoor) be skipped by diabetic patients during Ramadan?	24	13.3	156	86.7
If BSL is around 70mg/dl in the early hours of fasting, is it advised to immediately consult the physician and break the fast?	136	75.5	44	24.4
Is fasting allowed to a diabetic patient who is taking Insulin Injection to control his/her blood sugar?	81	45	99	55
Is fasting compulsory, for pregnant and diabetic women?	39	21.7	141	78.3
Females with diabetes should fast even when they breastfeed their babies?	62	34.4	118	65.6
Should the Adolescents with brittle type -I diabetes fast?	128	71.1	52	28.9
If symptoms of Hypoglycemia are visible and felt by the patients, should they break fast?	132	73.3	48	26.7
Should Strenuous exercise and physical activity be avoided during fasting?	26	14.4	154	85.6
Is tarawih prayer an alternative to exercise during Ramadan?	107	59.4	73	40.6
Do you think that eating extra food in Sehri would have better control of blood sugar levels throughout the day?	97	53.9	83	46.1
Do you believe that a needle prick for testing your sugar levels in the blood is not allowed while fasting?	73	40.6	107	59.4
Is Aftar time, the best option for diabetes to take the medication during Ramadan?	138	76.7	42	23.3
Is adjustment of drug dosage and timings recommended for fasting diabetics?	147	81.7	33	18.3
Is "Aalim"(religious scholar) the most suitable person to advise the diabetic patient regarding Ramadan fasting?	99	55	81	45
Do you monitor your blood glucose level during fasting Ramadan?	78	43.3	102	56.7
Do you know the method how to inject insulin?	117	65	63	35
Have you ever received Islamic medical training on Ramadan fasting?	81	45	99	55
Have you ever taken medical advice from your GP before Ramadan on fasting?	89	49.4	91	50.6
In your opinion, does Ramadan fasting deteriorate your glycemic control?	81	45	99	55

DISCUSSION

The purpose of this study was to determine diabetic patients' knowledge, attitudes, and practices regarding fasting during the Holy Month of Ramadan. Furthermore, diabetic patients' socio-demographic factors such as age, gender, educational level, and diabetes type were investigated.

Male diabetic patients were found in greater numbers in this study than female diabetic patients. These findings contradict those of other studies from around the world, which show that diabetes affects more women than men (DM 5, 4, 7, 8, 15, 11, 30). (Table 5). In contrast to the current study, Abbasi et al., 2018¹⁵ and Elliott et al., 2018¹⁶ found that females are more likely than males to develop diabetes. Similarly, Hassanein et al., 2019 reported a higher percentage of females (54.4%) with diabetes than males (45.6%)¹⁷. Furthermore, Almaiki et al., 2018 found that 68.1 percent of females (68.1 percent of males) have diabetes, compared to 31.9 percent of males¹⁸. Mansour et al., 2018 also reported similar findings that

males (34.6 percent) are less affected as compared to females (65.4 percent)¹⁹. According to Zainudin et al., 2018 from Singapore, females have the highest percentage of diabetes (85.2%) compared to males (14.8%)²⁰. Essa et al., 2019 from Saudi Arabia reported similar findings that females are more affected than male patients²¹.

Diabetes mellitus type II was assessed in 92.8 percent of participants, while diabetes mellitus type I was assessed in 7.2 percent. Our findings are consistent with previous research findings that type I diabetes is less common than type II diabetes (Table 5). Hassanein et al., 2019 found that Type II diabetes mellitus is more common than Type I diabetes mellitus, which is similar to the current study¹⁷. According to Zainudin et al., 2018, a study from Singapore found that type II diabetes is more common than type I diabetes²⁰. According to Almaiki et al., 2018, type II diabetes is more common than type I diabetes in Saudi Arabia¹⁸. Another study also found that type II diabetes is more common than type I diabetes¹⁹.

Table: 5 Comparison of different studies related to diabetes types and gender-wise distribution from various regions of the world

Studies	Year of study	Male	Female	DM Type I	DM Type II	Country	Reference
Present study	2021	53.9	46.1	7.2	92.8	Pakistan	
Abbasi et al.,	2018	47.4	52.6	-	-	Malaysia	15
Elliott et al.,	2018	38	62	08	92	Switzerland	16
Hassanein et al.,	2019	45.6	54.4	29.9	70.1	United Arab Emirates	17
Almaiki et al.,	2018	31.9	68.1	37.7	62.3	Saudi Arabia	18
Mansour et al.,	2018	34.6	65.4	18	82	Iraq	19
Zainudin et al.,	2018	14.8	85.2	3.8	96.2	Singapore	20
Essa et al.,	2019	45.3	54.7	-	-	Saudi Arabia	21

In the current study, it was discovered that people between the ages of 15 and 55 are more likely to develop diabetes (64.4%) than people older than 55 (35.6%). Almaiki et al., 2018 reported that the younger population is more vulnerable to the older age group, which is similar to the current findings¹⁸. On the other hand, according to Elliot et al., 2018 from Singapore, 46.6 percent of people aged 18 to 55 years have diabetes, while 53.4 percent of people aged 55 and up have diabetes¹⁶.

According to the findings of the current study, 85.6 percent of diabetic patients avoid strenuous exercise while fasting. Almaiki et al., 2018 found that 81.8 percent of diabetic patients avoid exercising while fasting¹⁸. During Ramadan, 86.7 percent of diabetic

patients ate Sehri (Sahoor), while 13.3 percent skipped it. Almaiki et al., 2018 study found that diabetic patients who take Sehri (Suhoor) but not at the last time of Sehri. In the current study, approximately 55% of diabetic patients did not receive Ramadan fasting training. According to a Saudi Arabian study, diabetic patients (54.3%) have received Ramadan fasting training¹⁸.

During Ramadan fasting, 43.3 percent of diabetic patients monitored their blood glucose levels. Almaiki et al., 2018 found that 61% of diabetic patients monitor their blood sugar levels while fasting¹⁸. During Ramadan fasting, blood glucose levels must be monitored to detect, prevent, and treat hypoglycemia. According to a Bangladeshi study, 23% of children broke their fast due to the

onset of severe hypoglycemia symptoms²². Young people, on the other hand, avoid breaking their fast, especially if hypoglycemia occurs near sunset²³.

Another study found that regardless of fasting time, a greater number of adolescents and children were willing to stop fasting after developing hypoglycemia²³. When diabetic patients felt hypoglycemia in a recent study, 73.3 percent agreed to break their fast. Almaiki et al. (2018) found that the majority of patients stopped fasting when they experienced hypoglycemia symptoms¹⁸. Regardless of fasting timing, breaking the Ramadan fast is recommended once hypoglycemia is detected. This advice can be used for both symptomatic and asymptomatic hypoglycemia with a blood sugar level of less than 3.9 mmol/L (70 mg/dl)²⁴.

Limitations and Recommendations: This study has a few limitations, including the fact that it was conducted in a single center with small sample size. Furthermore, there is a risk of self-reporting bias because patients may be reluctant to reveal any flaws, and such data is suspect. Another limitation of this study is the lack of a control group. Cultural and religious issues may arise as a result of such research.

To fully understand the safe management of diabetic patients during Ramadan fasting, multi-center studies with larger sample size and a control group are required. To assist diabetic patients, pre-Ramadan training sessions are required. Both diabetic type I and type II patients require pre-Ramadan counseling to address insulin type, glucose monitoring, physical activities, nutrition, sick days, and hypoglycemia and hyperglycemia symptoms. When it comes to fasting and sickness, proper Islamic rules must be understood.

CONCLUSION

This study examines diabetic patients' Ramadan fasting knowledge, attitudes, and practices. The findings of this study revealed that people who are younger and male are more likely to develop diabetes. In our region, type II diabetes is more common than type I diabetes. This research reveals the knowledge and practice gap on diabetes and other related topics. As a result, it is critical to organize annual educational training for health care providers to keep their knowledge up to date, as well as to provide appropriate training to diabetic patients to ensure safe Ramadan fasting practices. Furthermore, public health programs addressing diabetes management should be developed and implemented. These programs will increase safe Ramadan fasting practices, which will help to reduce and prevent diabetes-related complications.

REFERENCES

- Bohl M, Doron T. Type 1 and type 2 diabetes: warning signs and symptoms. *Diabetes*. 2019.
- Balaji R, Duraisamy R, Kumar M. Complications of diabetes mellitus: A review. *Drug Invention Today*. 2019;12(1).
- Matos M, Mendes R, Silva AB, Sousa N. Physical activity and exercise on diabetic foot related outcomes: a systematic review. *Diabetes Research and Clinical Practice*. 2018;139:81-90.
- Parkkola A, Turtinen M, Härkönen T, Ilonen J, Knip M. Family history of type 2 diabetes and characteristics of children with newly diagnosed type 1 diabetes. *Diabetologia*. 2021;64(3):581-90.
- Zheng Y, Ley SH, Hu FB. Global aetiology and epidemiology of type 2 diabetes mellitus and its complications. *Nature reviews endocrinology*. 2018;14(2):88-98.
- Meo SA, Zia I, Bukhari IA, Arain SA. Type 2 diabetes mellitus in Pakistan: Current prevalence and future forecast. *JPMA The Journal of the Pakistan Medical Association*. 2016;66(12):1637-42.
- Lewandowska M, Więckowska B, Sajdak S. Pre-pregnancy obesity, excessive gestational weight gain, and the risk of pregnancy-induced hypertension and gestational diabetes mellitus. *Journal of clinical medicine*. 2020;9(6):1980.
- Robert AA, Al Dawish MA. The worrying trend of diabetes mellitus in Saudi Arabia: an urgent call to action. *Current diabetes reviews*. 2020;16(3):204-10.
- Malek R, Hannat S, Nechadi A, Mekideche FZ, Kaabeche M. Diabetes and Ramadan: A multicenter study in Algerian population. *Diabetes research and clinical practice*. 2019;150:322-30.
- Alsunni AA, Albaker WI, Almansour AH, Alenazi AS, Alaftan MS, Badar A. Knowledge, attitude and practice regarding ramadan fasting and related determinants in patients with type 2 diabetes at a Saudi Diabetes Clinic. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*. 2020;13:151.
- Bajaj HS, Abouhassan T, Ahsan MR, Arnaout A, Hassanein M, Houlden RL, et al. Diabetes Canada position statement for people with types 1 and 2 diabetes who fast during Ramadan. *Canadian Journal of Diabetes*. 2019;43(1):3-12.
- Kenz S, Abusahmin H, Elmalti A, Beshyah SA. The 8th diabetes and ramadan international alliance conference: January 23–24, 2020, Dubai, United Arab Emirates. *Ibnosina Journal of Medicine and Biomedical Sciences*. 2020;12(1):62.
- international Darp, diabetes federation (IDF) icwtD, 2016. aRDIAA.
- Ababou M, Ababou R, El Maliki A. Le jeûne du Ramadan au Maroc: un dilemme pour les patients diabétiques et les soignants. *Sciences sociales et santé*. 2008;26(2):79-104.
- Abbasi YF, See OG, Ping NY, Balasubramanian GP, Hoon YC, Paruchuri S. Diabetes knowledge, attitude, and practice among type 2 diabetes mellitus patients in Kuala Muda District, Malaysia—A cross-sectional study. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*. 2018;12(6):1057-63.
- Elliott JA, Das D, Cavaller P, Schneider F, Shah M, Ravaud A, et al. A cross-sectional assessment of diabetes self-management, education and support needs of Syrian refugee patients living with diabetes in Bekaa Valley Lebanon. *Conflict and health*. 2018;12(1):1-10.
- Hassanein M, Abdelgadir E, Bashier A, Rashid F, Al Saeed M, Khalifa A, et al. The role of optimum diabetes care in form of Ramadan focused diabetes education, flash glucose monitoring system and pre-Ramadan dose adjustments in the safety of Ramadan fasting in high risk patients with diabetes. *Diabetes research and clinical practice*. 2019;150:288-95.
- Almalki MH, Hussen I, Khan SA, Almaghamsi A, Alshahrani F. Assessment of Ramadan education and knowledge among diabetic patients. *Clinical Medicine Insights: Endocrinology and Diabetes*. 2018;11:1179551417751611.
- Mansour A, Shiaa N, Ajeel N. Attitude of patients with diabetes mellitus toward fasting Ramadan in Basrah Iraq. *Endocrinol Metab Int J*. 2018;6(1):00146.
- Zainudin SB, Hussain AB. The current state of knowledge, perception and practice in diabetes management during fasting in Ramadan by healthcare professionals. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*. 2018;12(3):337-42.
- Ba-Essa EM, Hassanein M, Abdulrhman S, Alkhalifa M, Alsafar Z. Attitude and safety of patients with diabetes observing the Ramadan fast. *Diabetes Research and Clinical Practice*. 2019;152:177-82.
- Zabeen B, Tayyeb S, Benarjee B, Baki A, Nahar J, Mohsin F, et al. Fasting during Ramadan in adolescents with diabetes. *Indian journal of endocrinology and metabolism*. 2014;18(1):44.
- Deeb A, Al Qahtani N, Akle M, Singh H, Assadi R, Attia S, et al. Attitude, complications, ability of fasting and glycemic control in fasting Ramadan by children and adolescents with type 1 diabetes mellitus. *Diabetes Research and Clinical Practice*. 2017;126:10-5.
- Deeb A, Elbarbary N, Smart CE, Beshyah SA, Habeb A, Kalra S, et al. ISPAD Clinical Practice Consensus Guidelines: Fasting during Ramadan by young people with diabetes. *Pediatric Diabetes*. 2020;21(1):5-17.