

Management of pregnant women living with type one diabetes mellitus during Ramadan: a theoretical case-presentation discussion

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The Ramadan period is highly significant in the Muslim religion which is characterised by fasting from dawn until dusk. In this case scenario, a 23-year old Muslim woman from Somalia expressed her wishes to fast even though this poses a high risk due to the presence of both type one diabetes mellitus and pregnancy. A management plan was devised to fast safely for optimal wellbeing of her foetus and herself. This consisted of carrying out a thorough assessment and identifying her current needs. Dietary pattern was the major feature of the care plan due to its sudden changes in Ramadan. A modified nutrition plan was advised in this scenario, allowing for a balanced diet in iftar and sahur with adequate caloric intake. No additional plans for physical exercise were sought as physical exertions associated with Tarawih prayers were considered sufficient. Insulin management is important since this accompanies meals and adjustments may need to be made. Therefore, providing education in self-monitoring of blood glucose and injecting insulin is paramount. Follow-up by an obstetric care provider during Ramadan is essential.

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CASE SCENARIO

A 23-year-old migrant Muslim woman from Somalia with a BMI of 19 kg/m² was seen in her first pregnancy at the antenatal clinic at 12 weeks of pregnancy. She has a history of Type 1 Diabetes Mellitus of eight years duration and was referred for subsequent management by the specialist diabetes in pregnancy team. She currently lives at the Open Centre for migrants. At 23 weeks gestation, she informs the team that she intends to fast during the coming Ramadan and wishes appropriate advice about how to safely manage her diabetes in the circumstances.

INTRODUCTION

Religious beliefs generally evoke a strong reaction from its followers. Ramadan is the ninth month of the Islamic calendar,¹ and is known as their holy month.² Fasting during Ramadan is one of the key pillars of this religion and is highly valued by Muslims.³ It is believed that this good deed will lead to a multiplication of spiritual rewards, increasing the desire to participate.⁴ The fast is observed from dawn to sunset and pregnant women are exempted from fasting. Despite this, some pregnant Muslim women with diabetes decide to fast, as in this case, against the standard medical suggestions.² If the patient wishes to fast for Ramadan, she will need adequate monitoring and insulin dose adjustments,² as well as responsibility from her side in terms of dieting, adhering to therapy and maintaining contact with the support team.³ This can only be successful with commitments from healthcare providers and dedication from the patient.² Ideally, the patient should be managed in a high-risk clinic by an obstetrician, diabetologist, nutritionist and a diabetes nurse educator.⁵

ASSOCIATED RISKS

Diet restriction in pregnancy can be related to adverse maternal and perinatal consequences. According to a previous study, high rates of foetal loss, low birth weight, and increased neonatal admission to the special care baby unit were reported in women following Ramadan.⁶ In a study carried out by Alwasel et al,⁷ reduced placental weight was observed in mothers who were in their second and third trimester when fasting although birth weight was unaffected, however, this may have an effect on foetal programming leading to long-term health implications. Data from Iraq and Uganda also suggests a link between prenatal exposure to fasting and learning disabilities in adulthood.⁴ Contrastingly, several other studies which were conducted on healthy pregnant women during Ramadan have resulted in no complications or detrimental effects on both mother and child.² Several profound metabolic alterations are observed in gestation. In pregnancy, women are more vulnerable to elevated ketonemia and hypoglycaemia after a period of fasting. Metabolic adaptation to calorie restriction includes the release of ketoacids, acetoacetic acid and β -hydroxybutyric acid, to replace glucose as the primary substrate. Therefore, transient ketonemia and ketonuria can occur due to energy restriction and hypohydration.⁸ In addition to this, fasting in itself leads to alterations in blood glucose, lipid profile, haematological parameters, and body weight.⁹ Moreover, a drop in blood pressure is characteristic of the second trimester in pregnancy. This may be provoked during prolonged fasting. Foetal compromise is indicated by reduced foetal movements or maternal signs and symptoms such as vomiting, tachycardia and postural hypotension. Acute onset oligohydramnios

implies foetal stress, and discourages fasting.¹⁰

PRE-RAMADAN ASSESSMENT

The ideal pathway in this scenario should commence with a pre-Ramadan assessment by health care providers, preferably six to eight weeks before the start of Ramadan. This should include the patient's comprehensive medical history, her glycaemic control, self-management capabilities, risk of hypoglycaemia, and her experience during previous Ramadan.⁴ Prior causation, recognition, and management of possible diabetic complications such as hyperglycaemia, hypoglycaemia, dehydration, impending diabetic ketoacidosis and hyperosmolar hyperglycaemic state should also be explored.¹¹ According to the International Diabetes Federation (IDF) and the Diabetes and Ramadan (DAR) International Alliance, The patient is considered a very high risk patient as she is pregnant and probably makes use of insulin as she lives with type one diabetes.¹² The primary objective of healthcare providers is to advise the patient not to fast, explaining the possible risks as described above. However, if she still decides to fast, she should be given appropriate support and knowledge to reduce the possible risks.¹³ Moreover, it is crucial that she self-monitors her blood glucose several times daily.⁴ If possible, the healthcare provider can check urine for ketones, as well as temperature, pulse, and breathing rate.¹¹ Healthcare providers also have a significant role in close monitoring of the patient since she is at high risk.¹⁴ A care plan should be designed to accommodate the patient. There is no one-plan-fits-all, as each individual will have specific factors that will influence the treatment strategy.⁴ Patient empowerment is

significant to increase motivation and active participation, ensuring total compliance not only during the Ramadan period but for as long as possible.¹¹ The patient's family, if present, are encouraged to attend to educative sessions so that they also can be aware of hypoglycaemia and hyperglycemic symptoms, meal planning, blood glucose monitoring, insulin administration, exercise and management of acute complications.¹⁵

The six Cs in nursing care are vital when delivering patient care and should be followed. These consist of: care, compassion, competence, communication, courage, and commitment. The right care defines healthcare providers and it helps the individual personally. Compassion is care emitted through relationships based on respect, empathy, and dignity. Competence means being able to understand the individual's health and social needs. It involves clinical, expertise and technical knowledge. Communication is central to success and listening is as important as what healthcare providers must deliver. Courage enables healthcare providers to do the right deed for the individual, having the personal strength and vision to establish new methods of working. Commitment improves the care and experience of individuals continually to make this vision a reality.¹⁶ Furthermore, it is crucial to assess access to food of choice and links with others in the Somali community or family. This is because barriers faced by patients in this period include long distances to facilities including their monthly appointments and prescribed medication.¹⁷

DIET

The patient's nutrition should be assessed in the pre-Ramadan visit, if possible. This will provide an opportunity for healthcare

providers to give out a modified nutrition plan which will improve blood glucose control during fasting, medical nutrition therapy that can help if the patient is overweight so as to safely and successfully lose weight, education regarding recognition of symptoms such as dehydration, hypoglycaemia and other possible acute complications.¹⁸ The latter can be facilitated by attending a session with a dietitian.¹⁹ Adequate glycaemic control can be achieved by individuals with diabetes by maintaining appropriate nutrition,²⁰ as will be discussed below. The latter should involve meal planning and dietary advice, with a balanced diet of low glycaemic index, low intake of fats, and more intake of fresh fruit, vegetables, and high fibres.¹¹ Individuals are more prone to consuming foods high in carbohydrates during Ramadan, therefore, portion control should be included. Healthcare providers can follow the Ramadan Nutrition Plan, developed by the DAR International Alliance, which is a web-based tool used to deliver patient-specific nutrition education for Ramadan. Eid is a regularly ignored aspect in diabetes, which is a three-day festival after Ramadan consisting of high intake of calories and carbohydrates with family and friends, hence, this should also be addressed.²¹

As indicated above, exposure to a sub-optimal or limited diet during pregnancy can impact foetal development and has life-long health effects on the offspring.²² Instead of the usual intake of three meals daily, the Ramadan period limits individuals to only one main meal in a day.⁶ It is recommended to spread out three balanced meals during non-fasting hours which helps to prevent excessive rise in post-prandial glucose.²⁰ In Ramadan, Muslims' eating pattern usually includes iftar, which is the sunset meal and sahur, the dawn meal.² However, in Hossain and Zehra,²⁰ a meal plan

of a total of 1200 to 1400 kilocalories consisted of sahur, iftar, dinner and a bedtime snack. The patient should be allowed to choose her frequency of meals according to her own preferences in the non-fasting period, with sufficient caloric balance. Nonetheless, in pregnancy, it is best not to skip a bedtime snack due to change in dietary schedule and prolonged starvation. Sahur should be taken as late as possible before starting to fast again. Moreover, general dietary guidelines for Ramadan remain the same in pregnancy.²⁰

Iftar should commence with drinking plenty of water in order to overcome dehydration from fasting, and one or two dried fresh dates to raise blood glucose levels.¹⁸ Ingestion of water, sugar free drinks or fruit juices should be continued to compensate for water and electrolyte deficits.²³ Examples of iftar meals usually contain around 200 kilocalories and include the following: one date and half cup of kidney beans with vegetable, or one date and a cup of dahi-barey with chickpeas, or a pinch of salt and one cup fruit chat. The latter plan should be followed only if the patient is also planning to eat dinner afterwards of approximately 500 kilocalories and may consist of: once cup tossed salad, kofta curry and one a half chapati.²⁰ Other plans may involve iftar as the main meal which contains food similar to the ones described but reaches a total of around 700-900 kilocalories.¹⁸ It is crucial to avoid ingesting large amounts of foods rich in fats and carbohydrates, especially during iftar.²³ The patient should be advised to have dinner as early as possible at iftar. Following this meal, it is suggested to take a late night snack consisting of either a glass of milk or a portion of fruit to maintain normoglycaemia until the sahur meal.²⁰ Furthermore, some individuals make use of a

snack to break fasting during the day and then take iftar later in the evening.¹⁸

Sahur is an important meal as omission of this meal can lead to depletion of glycogen stores and ketosis earlier when fasting.²⁴ It is advised to proportionally distribute the caloric intake between sahur and iftar. For example, iftar should comprise 40 to 50 percent, sahur 30 to 40 percent, and snack 10 to 20 percent, of the total caloric intake. At sahur it is advisable to consume a balanced amount of fat and protein as these have a lower glycaemic index and induce satiety better than carbohydrate-rich foods. Plans should be given according to the nutritional needs of the patient and her body weight should be considered. Example of a typical sahur meal, as suggested by the DAR International Alliance, with 540 to 720 kilocalories includes: two wholegrain bread slices with one large egg, four tablespoons of milk with 3 tablespoons of oats and one handful of almonds, half tub of yoghurt, one small apple and water.¹⁸ Sugary food items should be limited especially during this meal.¹¹

Basically, low glycaemic index carbohydrates which are high in fibre are preferred comprising around 45 to 50 percent, protein comprising 20 to 30 percent, and fat, preferably mono and polyunsaturated comprising less than 35 percent, of the whole meal.¹⁸ Inclusion of fresh, steam cooked or boiled vegetable salads without oily dressings, fruit, yoghurt, lentils, whole serial made food items and non-vegetarian items which are grilled or steam cooked represent an ideal diet. Oil rich food items like pakodas, puris, parothas and samosas should be avoided as well as over-eating.¹¹ Keeping records of time of meal and snacks, together with portion sizes may be useful throughout this period.²⁵ When breaking the fast due to hypoglycaemia, the patient should consume a small amount of a

fast-acting carbohydrate such as a small carton of juice.¹³ In this scenario, The patient should avoid high phosphorous and potassium diets such as dates, fried foods, cheese, and tea. Additionally, she should drink up to one to 2.5 litres of water to rehydrate.²⁰

PHYSICAL EXERCISE

Rigorous exercise is not advised during fasting due to the higher risk of hypoglycaemia and dehydration. Regular light-to-moderate exercise can be encouraged, however, the patient should be informed that physical exertions involved in Tarawih prayers are considered part of daily exercise.¹³ These usually take place after the Iftar meal and consist of kneeling, rising and bowing.²¹ Seen from a physical point of view, this targets both isotonic and isometric muscular activity which covers most of the muscle groups in the body.²⁶ Additionally, people often walk to the mosque for these prayers, which is also considered part of the exercise regime.²⁷ If the patient wishes to partake in exercise, it is suggested that the ideal time to carry this out is two hours after sunset, which is in the non-fasting time. Exercise should be avoided in the final few hours of fasting as the risk of hypoglycaemia is maximal, especially since The patient likely makes use of insulin.²⁰ It is important to monitor blood glucose before, during and postexercise, if possible. If hypoglycaemia can be predicted, the fast should be broken. Moreover, benefits associated with physical activity include improvements in glycaemic values, lipid profile, body weight and mobility.²⁸

INSULIN MANAGEMENT

Strict medical supervision is essential in pharmacological management and there should be focused education on how to

manage glycaemic levels.²⁹ As a general overview, the regularly used option is once or twice daily injections of intermediate or long-acting insulin, together with premeal rapid-acting insulin. It is unlikely that regimens such as one or two injections of long-acting, intermediate, or premixed insulin would provide optimum insulin management. Continuous subcutaneous insulin infusion is another appealing option; however, this is costly and the patient's affordability should be taken into account.⁵ Access to appropriate treatment and testing should be assessed, as well as storage of insulin and supplies.³⁰

Dose adjustments need to be made by the physician since there is a long fasting period. The long-acting insulin should be reduced by 10 to 30 percent and taken at the sunset meal, iftar. If the patient is on twice daily mixed insulin, the sunset meal dose should be kept the same and the second dose decreased by 20 to 30 percent and taken with the pre-dawn meal, sahur. The rapid-acting insulin can be started with the same dose but may need to be increased at the sunset meal by 10 to 20 percent to avoid hyperlycaemia. The dose at Sahur meal should be kept the same, however, if morning hypoglycaemia occurs, this dose should be decreased by 10 to 20 percent or to omit completely if needed.³¹ If the patient was previously on a midday rapid-acting insulin regime, this should be omitted whilst fasting.²⁷ Another option could be using a basal-bolus insulin regime, although this can be safely achieved in people who are already in good health and have sufficient control.¹¹

Furthermore, a more flexible approach includes counting carbohydrates in each meal and adjusting the meal-related insulin doses using a simple algorithm.³² Principles of carbohydrate counting including correction doses are more significant during Ramadan as

type and quality of food differs from standard days. It could enable patients to control their hyperglycaemia without breaking their fast.³³ This could be included in the education session.³²

BLOOD GLUCOSE MONITORING

As mentioned previously, blood glucose monitoring is a cornerstone of Ramadan diabetes management.⁴ In some Muslim communities, there is a misconception that pricking the skin invalidates the Ramadan fast. Diabetes educators have a role to strongly emphasise that this is not the case. The patient should be provided with the knowledge and tools to carry out self-monitoring of blood glucose, to effectively self-manage her glucose levels, and identify events of hypoglycaemia and hyperglycaemia. This is particularly significant as the patient probably makes use of insulin, leading to a higher risk of hypoglycaemia.¹

The ideal monitoring times are outlined as follows: pre-sahur, in the morning, at midday, mid-afternoon, pre-iftar, two hours after iftar, and at any moment when there are symptoms of hypoglycaemia, hyperglycaemia, or feeling unwell.²⁹ In the latter scenario, the patient is advised to break the fast. The post-meal test decreases the risk of postprandial hyperglycaemia. Additionally, the patient should be encouraged to keep a Ramadan logbook with details of blood glucose measurements. The patient should break the fast if her blood glucose level drops below 3.9 mmol/L, if it rises above 16.7 mmol/L and if symptoms of hypoglycaemia or acute illness are present.²⁹ Medical help should be sought and any temptation to persevere with the fasting should be resisted.³⁴ If blood glucose level is between 3.9 to 5.0 mmol/L, the patient should re-check her blood glucose within one hour.²⁹

OBSTETRIC MANAGEMENT

It is crucial that the patient should be followed by an obstetric care provider throughout this period. During the second trimester, at 23 weeks, quickening would have already commenced, and it is important that abdominal circumference and fundal height are checked weekly. If there is less than one centimetre increase in either parameter weekly, prompt detailed investigations should be initiated and safety of fasting reconsidered. In addition, the foetus cannot tolerate periods of fasting for more than eight hours, therefore, the patient might consider to break the fast earlier, or start fasting later in the day. Loss of foetal movement is a definite signal to terminate fasting, as sudden intrauterine death can be precipitated by foetal hypoxia, hypoglycaemia, or hypokalaemia. Other contraindications to fasting include: non-reactive non-stress stress, poor biophysical score, oligohydramnios, intrauterine growth retardation and abnormal colour Doppler indices. Elevated liver enzymes and uric acid should also discourage fasting.¹⁰ Ramadan involves a religious act of fasting from early dawn until sunset. Debatable evidence exists whether this nutritional restriction affects foetuses negatively or if it has a nil effect. A pre-Ramadan assessment will be ideal in the case of the patient in order to assess her experience of living with diabetes. She is considered to be a very high risk patient

due to her pregnancy and high probable use of insulin. However, her decision to fast should be respected and a management plan should be outlined in so that she will fast in the safest possible method. A modified nutrition plan can be provided with the help of a dietitian. Dietary recommendations include eating well balanced diets according to the patient's preferences and drinking lots of water to prevent dehydration. If she needs to break the fast, a fast-acting carbohydrate should be ingested. Light exercise is suggested during this period although the Tarawih prayers can be regarded as exercise and deemed sufficient. Modifications in insulin treatment should be made by the physician's consultation and this should be reduced due to an increased risk of hypoglycaemia. In blood glucose monitoring, it is crucial to reassure the patient that this does not invalidate fasting. Since she lives with type one diabetes mellitus, she should self-monitor multiple times a day. Moreover, visiting an obstetric care provider in this period is significant so as to detect any abnormalities throughout the pregnancy.

ACKNOWLEDGEMENTS

I would like to show my gratitude to Dr. Roberta Sammut, Profs. Charles Savona-Ventura and Profs. Josanne Vassallo for their assistance and encouragement associated with this publication.

REFERENCES

1. Sahay, R., & Nagesh, S. Type 1 diabetes and fasting during Ramzan. *Journal of Social Health and Diabetes*. 2016 Jan-Jun 4(1):011-016
2. Ismail, N. A. M., Olaide Raji, H., Abd Wahab, N., Mustafa, N., Kamaruddin, N. A., & Abdul Jamil, M. Glycemic control among pregnant diabetic women on insulin who fasted during Ramadan. *Iranian Journal of Medical Sciences*. 2011 Dec 36(4):254-259.
3. Farooqi, H. M. Can type 1 diabetes patients safely fast during Ramadan? *Journal of Fasting and Health*. 2016 Sept 01;4(3):92.
4. Hassanein, M., Abdallah, K., & Buyukbese, M. A. Introduction to the IDF-DAR Practical Guidelines [Internet]. Brussels, Belgium: International Diabetes Federation. 2016 Apr [updated 2018 Feb 5; cited 2020 Jun 25]. Available from: <https://www.idf.org/e-library/guidelines/87-diabetes-and-ramadan-practical-25.html>
5. Al-Arouj, M., Assaad-Khalil, S., Buse, J., Fahdil, I., Fahmy, M., Hafez, S., . . . Thomas, A. Recommendations for management of diabetes during Ramadan. *Diabetes Care*. 2010 Aug 33(8):1895-1902
6. Baynouna Al Ketbi B. A, Latifa Mohammad, Niglekerke, N. J. D., Zein Al Deen, Sanna M, & Mirghani, H. Diet restriction in Ramadan and the effect of fasting on glucose levels in pregnancy. *BMC Research Notes*. 2014 Jun 24;7(1):392.
7. Alwasel, S. H., Abotalib, Z., Aljarallah, J. S., Osmond, C., Alkharaz, S. M., Alhazza, I. M., . . . Barker, D. J. P. Changes in placental size during Ramadan. *Placenta*. 2010 July 31(7):607-10.
8. Awwad, J., Usta, I., Succar, J., Musallam, K., Ghazeeri, G., & Nassar, A. The effect of maternal fasting during Ramadan on preterm delivery: A prospective cohort study. *BJOG: An International Journal of Obstetrics & Gynaecology* 2012 July 25;119(11):1379-86.
9. Kul, S., Savaş, E., Öztürk, Z., & Karadağ, G. Does Ramadan fasting alter body weight and blood lipids and fasting blood glucose in a healthy population? A meta-analysis. *Journal of Religion and Health*. 2014 Jun 53(3):929-942.
10. Kalra, B., Kalra, S., & Jawad, F. Ramadan fasting during pregnancy: Obstetric risk stratification. *JPMA J Pak Med Assoc*. 2018 Apr 68(4):666-668.
11. Jaleel, M., Raza, S., Fathima, F., & Jaleel, B. N. Ramadan and diabetes: As-saum (the fasting). *Indian Journal of Endocrinology and Metabolism*. 2011 Oct 01;15(4):268-273.
12. Al-Arouj, M., Ben-Nakhi, A., & Hassanein, M. Risk Stratification of Individuals with Diabetes before Ramadan [Internet]. Brussels, Belgium: International Diabetes Federation. 2016 Apr [updated 2018 Feb 5; cited 2020 Jun 25]. Available from: <https://www.idf.org/e-library/guidelines/87-diabetes-and-ramadan-practical-25.html>
13. Hassanein, M., & Ahmedani, M. Y. (2016). Pre-Ramadan education [Internet]. Brussels, Belgium: International Diabetes Federation. 2016 Apr [updated 2018 Feb 5; cited 2020 Jun 25]. Available from: <https://www.idf.org/e-library/guidelines/87-diabetes-and-ramadan-practical-25.html>
14. Alkandari, J. R., Maughan, R. J., Roky, R., Aziz, A. R., & Karli, U. The implications of Ramadan fasting for human health and well-being. *Journal of Sports Sciences: Supplementary Issue: Ramadan and Football*. 2012 Jun 29;30(1):S9-S19.
15. Hui, E., & Devendra, D. Diabetes and fasting during Ramadan. *Diabetes/Metabolism Research and Reviews*. 2010 Oct 11;26(8):606-10.
16. Chadwick, D. Care, compassion, courage, commitment, communication and competence: The 6 Cs. *Journal of Perioperative Practice*. 2017 Oct 01;27(10):209-211.
17. Beshyah, S., Badi, A., El-Ghul, A., Gabroun, A., Dougman, K., & Eledrisi, M. The year in "Ramadan fasting and health" (2018): A narrative review. *Ibnosina Journal of Medicine & Biomedical Sciences* 2019 Oct 10;11(4):151-170.
18. Hamdy, O., Yusof, B. N., Reda, W. H., Slim, I., Jamoussi, H., & Omar, M. (2016). The Ramadan Nutrition Plan (RNP) for Patients with Diabetes [Internet]. Brussels, Belgium: International Diabetes Federation. 2016 Apr [updated 2018 Feb 5; cited 2020 Jun 25]. Available from: <https://www.idf.org/e-library/guidelines/87-diabetes-and-ramadan-practical-25.html>

19. Ahmedani, M. Y., Haque, M. S., Basit, A., Fawwad, A., & Alvi, S. F. D. Ramadan prospective diabetes study: The role of drug dosage and timing alteration, active glucose monitoring and patient education. *Diabet Med* 2012 May 16;29(6):709-15.
20. Hossain, K., & Zehra, T. Diabetes and diet in Ramadan. *JPMA J Pak Med Assoc* 2015 May 28;65(5):S72-S75.
21. Ibrahim, M., Davies, M. J., Ahmad, E., Annabi, F. A., Eckel, R. H., Ba-Essa, E. M., . . . Umpierrez, G. E. Recommendations for management of diabetes during Ramadan: Update 2020, applying the principles of the ADA/EASD consensus. *BMJ Open Diabetes Research and Care* 2020 May 04;8(1):e001248.
22. Glazier, J. D., Hayes, D. J. L., Hussain, S., D'Souza, S. W., Whitcombe, J., Heazell, A. E. P., & Ashton, N. The effect of Ramadan fasting during pregnancy on perinatal outcomes: A systematic review and meta-analysis. *BMC Pregnancy and Childbirth*. 2018 Oct 09;18(1):421-11.
23. Mohsin, F., Azad, K., Zabeen, B., Tayyeb, S., Baki, A., & Nahar, N. Should type 1 diabetics fast in Ramadan. *JPMA J Pak Med Assoc* 2015 May 28;65(5):S26-9.
24. Hanif, W., Lessan, N., & Basit, A. (2016). Physiology of Ramadan Fasting [Internet]. Brussels, Belgium: International Diabetes Federation. 2016 Apr [updated 2018 Feb 5; cited 2020 Jun 25]. Available from: <https://www.idf.org/e-library/guidelines/87-diabetes-and-ramadan-practical-25.html>
25. Hakeem, R., Ahmedani, M. Y., Alvi, S. F. D., Ulhaque, M. S., Basit, A., & Fawwad, A. Dietary patterns and glycemic control and compliance to dietary advice among fasting patients with diabetes during Ramadan. *Diabetes Care* 2014 Feb 24;37(3):e47-e48.
26. Jaleel, M. A., Fathima, F. N., & Jaleel, B. N. F. Nutrition, energy intake- output, exercise, and fluid homeostasis during fasting in Ramadan. *Journal of Medical Nutrition and Nutraceuticals* 2013 Jul 06;2(2):63-68.
27. Ali, S., Davies, M. J., Brady, E. M., Gray, L. J., Khunti, K., Beshyah, S. A., & Hanif, W. Guidelines for managing diabetes in Ramadan. *Diabetic Medicine: A Journal of the British Diabetic Association* 2016 Jan 23;33(10):1315-1329.
28. Shaikh, A. Physical Activity in Ramadan. In: A. H. Zargar, & S. Kalra: *Ramadan & Diabetes Care* (1st ed.) New Delhi: Jaypee Brothers Medical Publishers; 2014, pp. 79-84.
29. Hassanein, M., Al-Arouj, M., Ben-Nakhi, A., Al-Madani, A., Shaltout, I., Alwadi, F., . . . Riaz, M. (2016). Management of Diabetes During Ramadan [Internet]. Brussels, Belgium: International Diabetes Federation. 2016 Apr [updated 2018 Feb 5; cited 2020 Jun 25]. Available from: <https://www.idf.org/e-library/guidelines/87-diabetes-and-ramadan-practical-25.html>
30. Grant, P. Management of diabetes in resource-poor settings. *Clinical Medicine* 2013 Feb 13(1):27-31.
31. Sunni, M., Brunzell, C., Nathan, B., & Moran, A. Management of diabetes during Ramadan: Practical guidelines. *Minnesota Medicine* 2014 Jun 97(6):36-8.
32. Eid, Y. M., Sahnoud, S. I., Abdelsalam, M. M., & Eichorst, B. Empowerment-based diabetes self-management education to maintain glycemic targets during Ramadan fasting in people with diabetes who are on conventional insulin: A feasibility study. *Diabetes Spectrum* 2017 Feb 15;30(1):36-42.
33. Alsaeed, D., Al-Kandari, J., & Al-Ozairi, E. Experiences of people with type 1 diabetes fasting Ramadan following structured education: A qualitative study. *Diabetes Res Clin Pract* 2019 May 28;153:57-165.
34. Ahmad, J., Pathan, M. F., Jaleel, M. A., Fathima, F. N., Raza, S. A., Khan, A. K. A., . . . Sheikh, A. Diabetic emergencies including hypoglycemia during Ramadan. *Indian Journal of Endocrinology and Metabolism* 2012 Jul-Aug 16(4):512-515.