

BMJ Open Eid-al-Fitr festivity and Ramadan fasting attitude among individuals with diabetes from Saudi Arabia and Pakistan: a cross-sectional study

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ABSTRACT

Objectives The present study aimed to assess the attitude of Saudi and Pakistani individuals with diabetes regarding Eid-al-Fitr festivities, exploring diabetes care during the month of Ramadan and these individuals' dietary patterns on Eid day.

Design Cross-sectional study.

Setting Jeddah (Saudi Arabia) and Karachi (Pakistan).

Participants Of the total 405 subjects, 204 individuals with diabetes from Saudi Arabia (SA) and 201 from Pakistan (Pak) were enrolled.

Data collection and analysis This survey-based study was carried out in SA and Pak after Eid-al-Fitr 2020. An online questionnaire was circulated via various social media platforms. The data analyses were performed using SPSS V.26.

Results There were 80 subjects with type 1 diabetes mellitus (DM) and 325 subjects with type 2 DM. Among our study subjects, 73 were on insulin, 260 were on oral antidiabetics (OADs) and 72 were taking both OADs and insulin. Two-thirds of the participants, 276 (68%) visited their physicians before Ramadan. Many participants (175, 43.2%) broke their fast a day or more because of diabetes. Many participants consumed sugary food on Eid day. The use of chocolates, sugary foods and fresh juices on Eid-al-Fitr was higher in Saudi subjects than in Pakistani ones ($p < 0.001$). Saudi subjects with diabetes adhered more strictly to medications during Ramadan than Pakistani subjects ($p = 0.01$). Saudi participants were more compliant with monitoring DM during Eid-al-Fitr compared with Pakistani subjects. Many participants in both groups felt stressed or depressed and stated that their Eid celebrations were restrictive because of their DM conditions.

Conclusions Most Saudi and Pakistani participants enjoyed Eid celebrations by abstaining from dietary restrictions. The sugar consumption attitude during Eid day was not up to the mark. Many subjects broke their fasts for a day or more because of diabetes. Saudis were more vigilant in monitoring DM than Pakistanis during Eid-al-Fitr. Individuals with diabetes should consult their physicians before Ramadan for checkups and counselling.

INTRODUCTION

Studies have shown that Ramadan fasting can be a pleasant experience for Muslims with diabetes. It gives opportunities to feel

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This cross-section study explores the Eid-al-Fitr festivities and Ramadan fasting attitude among individuals with diabetes from Saudi Arabia and Pakistan.
- ⇒ One of the limitations is the convenience sampling method.
- ⇒ The study used an online questionnaire, so we could not reach the section of society not using the internet.

sympathy for others who are deprived, develops self-control, improves willpower, strengthens their capability to endure overeating temptations and brings about a stronger feeling of modesty, spirituality and social involvement.^{1–4}

Ramadan's fast in the holy month is one of Islam's five pillars and, with certain exceptions, is regarded as obligatory for all adult Muslims who are sane and healthy. During a fast, a Muslim is not allowed to eat, drink or even take oral medication for diabetes mellitus (DM). Most people with diabetes enjoy the spiritual month of Ramadan by consecutively fasting for almost 29–30 days.⁵

Malek *et al* reported that 87.6% of individuals with diabetes practice fasting³; regardless of the risks and repercussions, they insist on fasting. A previous study from 13 countries regarding Epidemiology of Diabetes and Ramadan (EPIDIAR study) reported that fasting individuals' percentage for type 1 DM (T1DM) was 43% and type 2 DM (T2DM) was 86%.⁶ The month of Ramadan is 'packed' with religious fervour, and non-fasting Muslim individuals experience feelings of guilt.⁷ Because of the long hours of fasting and specific dietary patterns in Ramadan, individuals with diabetes are exposed to several risks, and healthcare providers have expressed concern about their patients who fast during



Ramadan. The risk of severe hypoglycaemia may increase up to fourfold in Ramadan.⁴ Similarly, the chances of hyperglycaemia and even ketoacidosis are increased in poorly controlled T1DM and T2DM.⁸ These complications are reported to increase almost fivefold during long fasting hours.⁹ Other risks include dehydration and increased chances of thromboembolic disorders.⁵

Saudi Arabia (SA) and Pakistan (PAK) are Muslim-majority countries. Both countries have significant differences in socioeconomic status and healthcare expenditures. According to a World Bank document, Pak's gross domestic product (GDP) was 262.61 billion US\$ in 2020, making it a lower-middle-income country. In comparison, SA is considered a high-income country, with 700.118 billion US\$ GDP in 2020.¹⁰ Pak's healthcare expenditure in terms of percentage of GDP was 3.8 in 2019, while SA's was 5.69.¹¹

In SA, the incidence of DM has tremendously increased from less than a million in 1992 to almost 25% in 2019 and is expected to double by 2030.¹² The incidence of DM in the adult population in Pak ranges from 7% to 20% in different regions of the country.¹³ The living style in both countries is different and has distinct cultural and social peculiarities. The participants were chosen from two countries because both have more than 90% Muslim populations and similar Eid-al-Fitr and Ramadan fasting behaviours among individuals. Thus, the present study aimed to assess the attitudes of Saudi and Pakistani individuals with diabetes regarding Eid-al-Fitr festivities, specifically investigating diabetes care during the month of Ramadan and their dietary patterns on Eid day.

METHODS

Study design and setting

The present survey-based study was designed at the Faculty of Medicine Rabigh, King Abdulaziz University, Jeddah, SA. It was carried out just after Eid-al-Fitr 2020 and completed within 2 months (15 June 2020 to 15 August 2020). There was a brief explanation of the survey's purpose at the start of the questionnaire, and the participants were allowed to proceed if they agreed. Data were collected from Jeddah (SA) and Karachi (Pak).

Data collection

An online questionnaire was prepared in English and translated and back-translated into Arabic and Urdu. A medical educationist and diabetologist checked the content and construct validity. It was further validated by conducting a pilot study among 30 subjects with DM to check the questionnaire's comprehension. The Cronbach's alpha was 0.79. The pilot study's results are not included in this manuscript. The different social media platforms appeal to various age groups. Therefore, the study questionnaire was circulated via various social media platforms (Facebook, Instagram, WhatsApp and Twitter) to overcome this limitation, and subjects with DM were requested to participate. Saudi and Pakistani

participants were sent a separate link to collect their data independently.

The questionnaire contained several parts, such as the demographic information of the participants, their dietary habits during Eid day, their medication patterns during Ramadan and their visits to the doctor during Ramadan. All participants were asked to recall the number of fasts they broke and whether they had consulted with a physician before or during the month of Ramadan. They were asked about the comfortability of fasting despite DM, monitoring DM and their activities during Eid day. Questions were also asked about other people's behaviour with them, their involvement in Eid activities and others (online supplemental questionnaire S1).

In our study, the most important exposure or independent variables were diabetes, Ramadan and Eid-al-Fitr, and the main outcome was the participants' attitude toward Eid-al-Fitr festivities and fasting during Ramadan.

Patient and public involvement

No patients were involved.

Statistical analysis

The analyses were performed using SPSS V.26. The discrete variables are presented as numbers and percentages. The χ^2 test was used to calculate the difference between two or more categorical variables. A $p < 0.05$ was considered statistically significant.

RESULTS

Of the total 405 subjects, 204 individuals with diabetes from SA and 201 from Pak were enrolled. There were 80 subjects with T1DM and 325 subjects with T2DM. Among our study subjects, 73 were on insulin, 260 were on oral antidiabetics (OADs) and 72 were taking both OADs and insulin. A significant difference was observed in age categories, type of diabetes, duration of diabetes and medication among Saudi and Pakistani subjects. Most Saudi individuals with diabetes had controlled blood glucose (BG) levels compared with their Pakistani counterparts ($p = 0.032$). Triglyceride levels were significantly more controlled in Pakistani subjects than in Saudi subjects ($p = 0.002$) (table 1).

Two-thirds of the participants, 276 (68%), visited their physicians before Ramadan. Many subjects with diabetes, 175 (43.2%), broke their fast a day or more because of diabetes. About one-quarter of the participants, 97 (24%), felt hypoglycaemic during the fast, and 313 (77.3%) participants stated that their BG level remained controlled during Ramadan. One-quarter of the participants, 104 (25.7%), felt stressed or depressed on Eid day because of diabetes. One-third of the participants, 149 (36.8%), admitted that their activities were restrictive because of diabetes on Eid day. Many people, 122 (30.1%), felt that people sympathised with them on Eid day because of their diabetes (table 2).

Table 1 Comparison of Saudi and Pakistani subjects with diabetes' demographics, medications and biochemical parameters (frequency, percentage and p value)

Characteristics	Saudi, N (%)	Pakistani, N (%)	P value
Age groups (years)			
20–29.9	49 (24)	7 (3.4)	<0.001*
30–39.9	30 (14.7)	60 (29.9)	
40–49.9	28 (13.7)	64 (31.8)	
50–59.9	47 (23)	51 (25.4)	
>60	50 (24.5)	19 (9.5)	
Gender			
Female	81 (39.7)	83 (41.3)	0.745
Male	123 (60.3)	118 (58.7)	
Diabetes type			
Type 1	64 (31.4)	16 (8)	<0.001*
Type 2	140 (68.6)	185 (92)	
Duration of diabetes (years)			
<5	64 (31.3)	90 (44.8)	<0.001*
5–9.9	52 (25.5)	67 (33.3)	
10–14.9	35 (17.2)	24 (11.9)	
15–19.9	20 (9.8)	12 (6)	
>20	33 (16.2)	8 (4)	
Medication			
Insulin	48 (23.5)	25 (12.4)	0.001*
Tablets	131 (64.2)	129 (64.2)	
Tablets and insulin both	25 (12.3)	47 (23.4)	
FPG (mmol/L)			
<5.6	52 (25.5)	31 (15.5)	0.032*
5.6–7.0	102 (50)	107 (52.2)	
>7	50 (24.5)	63 (31.3)	
HbA1c (%)			
<6.5	89 (43.6)	105 (52.2)	0.083
>6.5	115 (56.4)	96 (47.8)	
Cholesterol (mmol/L)			
<5.18	135 (66.2)	139 (69.2)	0.432
>5.18	69 (33.8)	62 (30.8)	
Triglycerides (mmol/L)			
<1.7	121 (59.3)	149 (74.1)	0.002*
>1.7	83 (40.7)	52 (25.9)	

*Significant p value.
FPG, fasting plasma glucose; HbA1c, glycated haemoglobin.

Questions regarding study participants' sugar consumption attitudes during Eid day showed that 84 (20.7%) used white sugar in tea or coffee. On Eid-ul-Fitr, artificial sweeteners were used by 75 (18.5%), chocolates by 91 (22.5%), sugary foods by 100 (24.7%), candies and sweets by 79 (19.5%), fatty foods by 125 (30.95), fruits by 243 (60%), vegetables by 282 (69.6%), fizzy drinks by 70 (17.355), salty foods by 149 (36.85) and fresh juices by 116 (28.6%) (table 3).

More Pakistani individuals visited their physicians during Ramadan than their Saudi counterparts ($p<0.001$). More than half of the study participants from both nationalities never broke their fast because of diabetes ($p=0.115$). More Saudi individuals observed hypoglycaemia during fasting than Pakistani subjects ($p<0.001$). In most participants, in both groups, the BG level remained controlled during Ramadan ($p=0.269$). Many participants in both groups felt stressed or depressed and stated that their Eid celebrations were restrictive because of DM. Moreover, they felt that people sympathised with them on Eid day ($p=0.102$) (table 4).

Saudi subjects with diabetes used less white sugar in tea or coffee on Eid-al-Fitr than Pakistani subjects ($p=0.031$). Chocolates, sugary foods and fresh juices on Eid-al-Fitr were used more by Saudi subjects than Pakistani ones ($p<0.001$). The consumption of fatty foods, fruits and salty food on Eid-ul-Fitr was higher in Pakistani diabetics than in Saudis ($p<0.001$, $p<0.001$, $p=0.003$, respectively) (online supplemental table S1).

Less than one-quarter of the study participants had eye complications. Saudi individuals with diabetes had a higher rate of renal (11.3% vs 4.5%) and foot (17.2% vs 7%) complications than Pakistanis. Saudi subjects with diabetes were strictly compliant with medications during Ramadan compared with Pakistani subjects ($p=0.01$) (online supplemental table S2). A comparison of Saudi and Pakistani participants' diabetes monitoring during Eid-al-Fitr days showed that Saudi participants were more compliant with monitoring DM during Eid-al-Fitr than Pakistani respondents. More than half of the participants scored their comfort of fasting in Ramadan as excellent and good, while about 12% considered it poor and very poor (results are not shown in the tables).

DISCUSSION

During Ramadan, BG control and monitoring are imperative concerns for individuals with diabetes. In the present study, most of the participants stated that their BG levels remained controlled during Ramadan. About half of the study participants' diabetes monitoring during Eid-al-Fitr days was self-controlled and regular. Similarly, a Turkish study reported that half of the study participants performed self-measurement of their blood glucose (SMBG).¹⁴ In contrast to our study, Malek *et al* reported less frequent SMBG during Ramadan.³ Surprisingly, one study pointed out that people believed getting a BG check meant a break from fasting.¹⁵

Saudi participants were more compliant with monitoring their DM than Pakistani subjects. This could be because of the availability of better healthcare facilities and specialised diabetic clinics in SA, thus improving the management and prolonging patients' lives because of fewer complications compared with Pak.¹⁶ Moreover, the healthcare facilities are free for all Saudi nationals, and the overall economic condition of the population is better than in Pak. Saudis are better educated than Pakistanis

Table 2 Attitude of individuals with diabetes during Ramadan and Eid (frequency and percentage)

Questions	No, N (%)	Yes, N (%)
Did you visit a doctor during the recent Ramadan?	265 (65.4)	140 (34.6)
Did you visit a doctor before the recent Ramadan?	129 (31.9)	276 (68.1)
Did you break the fast a day or more because of diabetes?	230 (56.8)	175 (43.2)
Did you observe hypoglycaemia while fasting?	308 (76)	97 (24)
Was Eid-al-Fitr a special day for you?	88 (21.7)	317 (78.3)
Did your blood sugar levels remain controlled during Ramadan?	92 (22.7)	313 (77.3)
Did you feel stressed or depressed on Eid day because of diabetes?	301 (74.3)	104 (25.7)
Did you perform all the activities on Eid day that you used to perform before developing diabetes?	125 (30.9)	280 (69.1)
Did you feel that you have celebrated Eid just like other people without any constraints?	144 (35.6)	261 (64.4)
Did you feel that your activities were restrictive on Eid day because of diabetes?	256 (63.2)	149 (36.8)
Did you feel that people had sympathy for you on Eid day?	283 (69.9)	122 (30.1)

(adult literacy rate is 97.5% in SA vs 58% in Pak).¹⁷ This disparity could also be attributed to differences in health literacy. According to the literature, 37.1% of Saudi individuals with diabetes have adequate health literacy,¹⁸ while 15.2% had adequate health literacy in Pak.¹⁹

In the present study, many of the respondents (43.2%) broke their fast a day or more because of diabetes. About one-quarter of the participants (24%) felt hypoglycaemia during the fast. Interestingly, our Saudi study cohort observed hypoglycaemic episodes, almost double the number compared with their Pakistani counterparts. A study from the UK reported 8% hypoglycaemia among subjects with diabetes during Ramadan.²⁰ Another Saudi study reported a much higher percentage of Saudi participants with T2DM (52%) who broke their Ramadan fast because of hypoglycaemia.⁴ A Libyan study reported that 22% of individuals with diabetes broke their fast for a day or two because of health concerns.²¹

Individuals with diabetes appear to perform less SMBG during Ramadan and avoid managing post-Iftar BG, which is the primary meal and source of glycaemic spikes. Our study results emphasise the importance of SMBG in avoiding sudden fluctuations in BG among individuals with diabetes; particularly, those who have diabetic complications should be more cautious while keeping their fast. The primary risks related to fasting in individuals with diabetes are hypoglycaemia, hyperglycaemia, diabetic ketoacidosis, dehydration and thrombosis.²² However, individuals with T1DM with poor glycaemic control are more likely to suffer problems when fasting.²²

One-quarter of the participants felt stressed or depressed on Eid day, and about one-third of the participants (36.8%) admitted that their activities were restrictive because of diabetes. A study reported that feasting and other religious festivals like Christmas are often stressful among people with diabetes because they are

Table 3 Study participants' sugar consumption attitude during Eid day (frequency and percentage)

Questions	No, N (%)	Sometimes, N (%)	Yes, N (%)
Were you using the following items on Eid-ul-fitr?			
White sugars to tea or coffee	225 (55.6)	96 (23.7)	84 (20.7)
Brown sugars to tea for coffee	269 (66.4)	106 (26.2)	30 (7.4)
Artificial sweeteners for tea or coffee	225 (55.6)	105 (25.9)	75 (18.5)
Chocolates	180 (44.4)	134 (33.1)	91 (22.5)
Sugary foods	153 (37.8)	152 (37.5)	100 (24.7)
Candies and sweets	184 (45.4)	142 (35.1)	79 (19.5)
Fatty foods	140 (34.6)	140 (34.6)	125 (30.9)
Fruits	62 (15.2)	100 (24.7)	243(60)
Vegetables	56 (13.8)	67 (16.5)	282 (69.6)
Salty foods	112 (27.7)	144 (35.6)	149 (36.8)
Fizzy drinks	243(60)	92 (22.7)	70 (17.3)
Canned juices	293 (72.3)	75 (18.5)	37 (9.1)
Fresh juices	191 (47.2)	98 (24.2)	116 (28.6)

Table 4 Comparison of Saudi and Pakistani individuals with diabetes' attitudes during Ramadan and Eid (frequency, percentage and p value)

Characteristics	Saudi		Pakistani		P value
	n	%	n	%	
Did you visit a doctor during recent Ramadan?					
No	175	85.8	90	44.8	<0.001*
Yes	29	14.2	111	55.2	
Did you visit a doctor before recent Ramadan?					
No	67	32.8	62	30.8	0.666
Yes	137	67.2	139	69.2	
Did you break the fast a day or more because of diabetes?					
No	108	52.9	122	60.7	0.115
Yes	96	47.1	79	39.3	
Did you observe hypoglycaemia while fasting					
No	139	68.1	169	84.1	<0.001*
Yes	65	31.9	32	15.9	
Was Eid-al-Fitr a special day for you?					
No	58	28.4	30	14.9	0.001*
Yes	146	71.6	171	85.1	
Did your blood sugar levels remain controlled during Ramadan?					
No	51	25.0	41	20.4	0.269
Yes	153	75.0	160	79.6	
Did you feel stressed or depressed on Eid day because of diabetes?					
No	145	71.1	156	77.6	0.132
Yes	59	28.9	45	22.4	
Did you perform all the activities on Eid day that you used to perform before developing diabetes?					
No	68	33.3	57	28.4	0.278
Yes	136	66.7	144	71.6	
Did you feel that you have celebrated Eid just like other people without any constraints?					
No	71	34.8	73	36.3	0.750
Yes	133	65.2	128	63.7	
Did you feel that, on Eid day, your activities were restrictive because of diabetes?					
No	123	60.3	133	66.2	0.220
Yes	81	39.7	68	33.8	
Did you feel that people had sympathy for you on Eid day?					
No	135	66.2	148	73.6	0.102
Yes	69	33.8	53	26.4	

*Significant p value.

forced to avoid delicious and sweet foods.²³ Hence, this could be one of the reasons for their stress or depressive feeling. Improving the health literacy knowledge of individuals with diabetes is necessary. It has been reported that, individually, adequate health literacy enables people to properly understand and implement their doctors' recommendations, contributing to a higher quality of life.²⁴ According to a systematic review, low health literacy is associated with poor health outcomes and less use of healthcare services.²⁵ It is suggested that more

health-literate individuals with diabetes may exhibit more optimistic attitudes and behaviours, practice better self-care and, thus, experience better health outcomes.

Many of the study participants consumed sugar-containing items during Eid-al-Fitr days. This is quite understandable because Eid is celebrated with sweets. People prepare sweet dishes at their homes, and their guests bring sweets like cakes and chocolates. Therefore, it is not surprising that even subjects with diabetes eat sweets on Eid day. However, people with diabetes



should be cognisant about checking their BG levels more frequently on Eid day than on other days and avoid too many oily sweet dishes, rice and other refined sugar-containing food items and drinks.² Many sweets and beverages in the market now contain artificial sweeteners, so they should consume those items if they have an urge for something sweet.

Eid day is tempting for people with diabetes. Individuals' education and pre-Ramadan evaluation have been stressed as a way to enable them to cope with the Ramadan fasts in a better way.^{2 5 26–28} Health experts mostly advise people with diabetes regarding controlled consumption of food during participation in Eid-al-Fitr celebrations.

Our study has a few limitations. The study's small sample size and online nature were two significant drawbacks. Online surveys have many disadvantages, including an inability to access users who do not use social media and repeated reminders to complete the survey, which can irritate participants. Because of the lack of accountability in online surveys, the likelihood of false responses increases. Our questionnaire did not specify whether fizzy drinks contained sugar or not. One of the limitations is that we did not ask whether they kept fasting during the whole month of Ramadan or irregularly. More extensive studies are required to gain insights into the perspectives of Saudi and Pakistani individuals during Eid festivities so that the results can be generalised.

CONCLUSION

The current study showed that most Saudi and Pakistani participants enjoyed Eid festivities by stopping their usual dietary restrictions. Sugar consumption attitude during Eid day was not good. Many subjects broke their fast for a day or more because of diabetes. Saudis were more vigilant in monitoring DM than Pakistanis during Eid-al-Fitr. Several of the participants' activities were restrictive because of their diabetes on Eid day. Diabetes individuals should consult with their treating physicians prior to Ramadan to ensure a successful fast and avoid complications.

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REFERENCES

- Myers PR, Shojirat N, Allen DH, *et al.* Patients with diabetes observing Ramadan: the experience of Muslims in the United States. *Diabetes Res Clin Pract* 2019;150:282–7.
- Hassanein M, Al-Arouj M, Hamdy O. Diabetes and Ramadan: practical guidelines on behalf of the International diabetes Federation (IDF), in collaboration with the diabetes and Ramadan (Dar) International alliance. *Diabetes Res Clin Pract* 2017;126:303–16.
- Malek R, Hannat S, Nechadi A, *et al.* Diabetes and Ramadan: a multicenter study in Algerian population. *Diabetes Res Clin Pract* 2019;150:322–30.
- AlKhaldi Y, AlKhaldi A, AlQahtani A, *et al.* Incidence of hypoglycemia and its risk factors among diabetics during Ramadan in Abha City, Aseer region, KSA. *J Family Med Prim Care* 2019;8:2793–8.
- Hanif W, Patel V, Ali SN, *et al.* The South Asian health Foundation (UK) guidelines for managing diabetes during Ramadan. *Diabetes Res Clin Pract* 2020;164:108145.
- Salti I, Bénard E, Detournay B, *et al.* A population-based study of diabetes and its characteristics during the fasting month of Ramadan in 13 countries: results of the epidemiology of diabetes and Ramadan 1422/2001 (EPIDIAR) study. *Diabetes Care* 2004;27:2306–11.
- Ahmed SH, Chowdhury TA, Hussain S, *et al.* Ramadan and diabetes: a narrative review and practice update. *Diabetes Ther* 2020;11:2477–520.
- Beshyah SA, Hassanein M, Ahmedani MY, *et al.* Diabetic hypoglycaemia during Ramadan fasting: a trans-national observational real-world study. *Diabetes Res Clin Pract* 2019;150:315–21.
- Beshyah SA, Chowdhury TA, Ghouri N, *et al.* Risk of diabetic ketoacidosis during Ramadan fasting: a critical reappraisal. *Diabetes Res Clin Pract* 2019;151:290–8.
- Gross domestic product (GDP). Available: <https://data.worldbank.org/country>. [Accessed 15 Feb 2022].

- 11 Current health expenditure (% of GDP). Available: <https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS> . [Accessed 15 Feb 2022].
- 12 Robert AA, Al Dawish MA. The worrying trend of diabetes mellitus in Saudi Arabia: an urgent call to action. *Curr Diabetes Rev* 2020;16:204–10.
- 13 Adnan M, Aasim M. Prevalence of type 2 diabetes mellitus in adult population of Pakistan: a meta-analysis of prospective cross-sectional surveys. *Ann Glob Health* 2020;86:7.
- 14 Peeters B, Mehuys E, Van Tongelen I, *et al.* Ramadan fasting and diabetes: an observational study among Turkish migrants in Belgium. *Prim Care Diabetes* 2012;6:293–6.
- 15 Masood SN, Sheikh MA, Masood Y, *et al.* Beliefs of people with diabetes about skin prick during Ramadan fasting. *Diabetes Care* 2014;37:e68–9.
- 16 El-Malky AM, Alharbi AS, Alsaqabi AM, *et al.* COVID-19 specialized diabetes clinic model for excellence in diabetes care: scientific perspective. *Clin Diabetol* 2020;9:208–11.
- 17 World and national data, maps and ranking. world data atlas. Available: <https://knoema.com/atlas> [Accessed 15 Feb 2022].
- 18 ALSharit BA, Alhalal EA. Effects of health literacy on type 2 diabetic patients' glycemic control, self-management, and quality of life. *Saudi Med J* 2022;43:465–72.
- 19 Saeed H, Saleem Z, Naeem R, *et al.* Impact of health literacy on diabetes outcomes: a cross-sectional study from Lahore, Pakistan. *Public Health* 2018;156:8–14.
- 20 Chowdhury TA *et al.* A survey of patients with type 2 diabetes and fasting outcomes during Ramadan 2016 in London: the East London diabetes in Ramadan survey. *Br J Diabetes* 2017;17:149–51.
- 21 Elbarsha A, Elhemri M, Elmehdawi R. Comparison between high- and low-risk diabetic patients who fast Ramadan: a prospective cohort study. *Ibnosina Journal of Medicine and Biomedical Sciences* 2020;12:208–14.
- 22 Al-Arouj M, Assaad-Khalil S, Buse J, *et al.* Recommendations for management of diabetes during Ramadan: update 2010. *Diabetes Care* 2010;33:1895–902.
- 23 Hillson R. Fasting, feasting, feet: religious festivals and diabetes. *Pract Diab* 2019;36:6–8.
- 24 Nutbeam D. Health literacy as a public health goal: a challenge for contemporary health education and communication strategies into the 21st century. *Health Promot Int* 2000;15:259–67.
- 25 Berkman ND, Sheridan SL, Donahue KE, *et al.* Low health literacy and health outcomes: an updated systematic review. *Ann Intern Med* 2011;155:97–107.
- 26 Ibrahim M, Abu Al Magd M, Annabi FA, *et al.* Recommendations for management of diabetes during Ramadan: update 2015. *BMJ Open Diabetes Res Care* 2015;3:e000108.
- 27 International Diabetes Federation (IDF), Diabetes and Ramadan (DAR) International Alliance. *Diabetes and Ramadan Practical Guidelines 2021*, 2021.
- 28 Al Awadi FF, Echtay A, Al Arouj M, *et al.* Patterns of Diabetes Care Among People with Type 1 Diabetes During Ramadan: An International Prospective Study (DAR-MENA T1DM). *Adv Ther* 2020;37:1550–63.