

# Diabetes during Ramadan: underestimated, under-investigated, needs more attention

A. HASSAN, S.A. MEO<sup>1</sup>

University Diabetes Center, King Saud University, College of Medicine, Riyadh, Saudi Arabia

<sup>1</sup>Department of Physiology, College of Medicine, King Saud University, Riyadh, Saudi Arabia

**Abstract. – OBJECTIVE:** In Ramadan, Muslim adults fast from sunrise to sunset for a period of a month. Due to paucity of data it seems that, diabetes mellitus during Ramadan is underestimated and the statistics are not a reflection of the actual reality. The aim this study is to highlight the staggering demographics in the diabetic Muslim population and emphasize its ramifications on fasting during Ramadan.

**METHODS:** In this study, we identified 37 published studies through a systematic database searches including ISI-Web of Science and PubMed. We searched the related literature by using the key words Diabetes Mellitus, Ramadan Fasting, Ramadan Fasting complications. Studies in which Diabetes Mellitus, Ramadan Fasting was discussed were included in the study. No limitations on publication status, study design or language of publication were obligatory. Finally we included 19 publications and remaining 18 were excluded.

**RESULTS:** Today's emerging diabetes hotspots in Muslim majority countries are the Middle East, Western Pacific, Sub-Saharan Africa and South-East Asia. Poverty, lack of education, poor healthcare, minimum available data and inappropriate guidance for the diabetic patients are the major risk factors resulting in serious complication during fasting in the month of Ramadan.

**CONCLUSIONS:** Still there are big gaps in the management of diabetic patients during Ramadan, the care of diabetic patients is fragmented and it is felt that diabetes during Ramadan is underestimated, under-investigated and needs more attention. It is vital to empower the healthcare workers and the patients in the frontlines with the appropriate information about Ramadan fasting in diabetic patients. Diabetic patients who fast during Ramadan should be adequately investigated and engaged in a structured Ramadan-focused diabetes education to undertake the fast safely.

*Key Words:*

Diabetes Mellitus, Fasting, Ramadan.

## Introduction

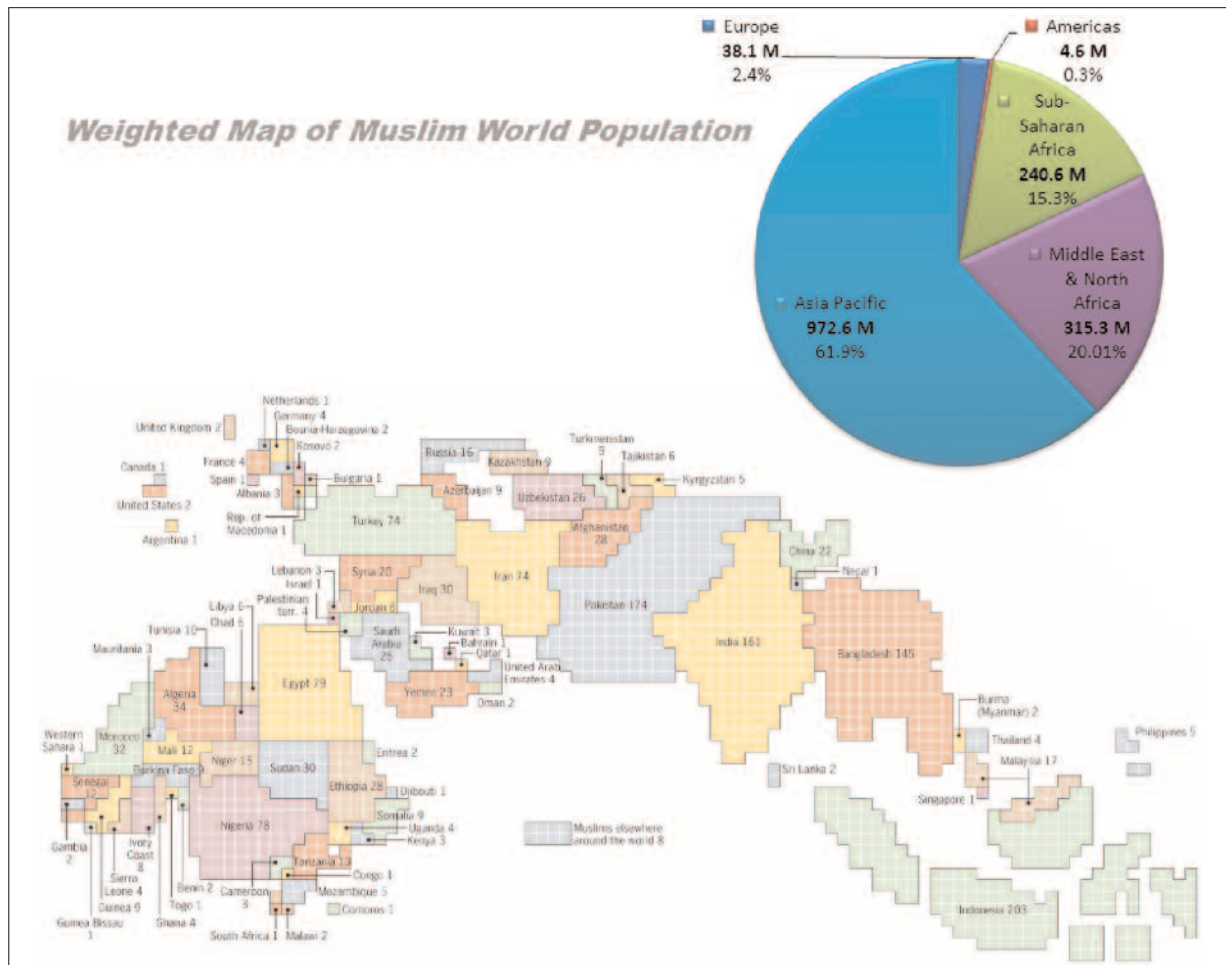
Of the 193 member states of the United Nations 57 countries are Muslim Majority Countries

(MMC), with a population of about 2.08 billion or approximately one-fourth of the world population<sup>1</sup>. The maximum percentage of Muslim population is in Asia Pacific 972.6 million (61.9%), Middle East and North Africa 315.3 million (20.01%), Sub Saharan Africa 240.6 million (15.3%), Europe 38.1 million (2.4%), America 4.6 million (0.3%)<sup>2</sup>.

International Diabetes Federation's most recent estimates indicate that 8.3% of adults (382 million people) have diabetes, and the number of people with the disease is set to rise beyond 592 million in less than 25 years or one adult in 10, will have diabetes<sup>3,4</sup>. Prevalence rates of diabetes exhibit geographical variations all over the world with emerging diabetes hotspots in countries in the Middle East, Western Pacific, Sub-Saharan Africa and South-East Asia where one in ten adults in the region have the disease. In terms of the prevalence of diabetes among adults, the Middle East and North Africa Region has the highest prevalence rate of 10.9%<sup>4</sup>. Looking into this pandemic more closely it is noticeable that over 90% of the world's Muslim population is concentrated in these regions (Figure 1). Moreover the evidence published in the International Diabetes Federation (IDF) 2014<sup>4</sup> report reveals that 80% of people with diabetes live in low and middle income countries, and the socially deprived in any country are the most vulnerable. These countries are facing a firestorm of ill health with inadequate resources to protect their population.

Global health spending to treat diabetes and manage complications totaled at least USD 548 billion in 2013 and there is a large disparity in health spending on diabetes between regions and countries. Only 20% of global health expenditure on diabetes was made in low- and middle-income countries, where 80% of people with diabetes live<sup>5,6</sup>.

Approximately 8.3% of adults prevalence of diabetes worldwide 382 million people<sup>4</sup> coupled



**Figure 1.** Mapping of the global Muslim population. The Figure is adopted and modified with permission from Pew Research center forum on region and public life.

with the results of the population-based Epidemiology of Diabetes and Ramadan (EPIDIAR) study, which showed that about 43% of patients with type 1 diabetes and ~79% of patients with type 2 diabetes fast during Ramadan<sup>7</sup>, lead to the estimates that some 40-50 million people with diabetes worldwide fast during Ramadan.

Muslims are globally widespread with some privileged enough to have type 2 diabetes mellitus (T2DM) management that involves health care professionals who are aware of the fasting practices, adjustments to their therapeutic regimens to suit their clinical profiles, and provision of Ramadan-specific diabetes education<sup>8</sup>. In contrast, patients in poor countries or deprived and remote communities face huge challenges related to the adequacy of and access to health care, availability of medications and storage problems. This is in addition to the difficulties in providing

the necessary Ramadan-focused diabetes education. The purpose of this study is to highlight the staggering demographics in the diabetic Muslim population and emphasize its ramifications on fasting during Ramadan.

## Selection of Studies

### Methods

The present study was conducted in the University Diabetes Centre, and Department of Physiology, College of Medicine, King Saud University, Riyadh, Saudi Arabia. In this study, we identified 37 published studies through a systematic database searches including ISI-Web of Science and PubMed. We searched the related literature by using the key words including Diabetes mellitus, Ramadan Fasting. We identified

37 research documents published on Ramadan fasting, epidemiology, risk factors, complications and diabetes educators' role, available in ISI-Web of Science and PubMed. We searched the related literature by using the keywords including diabetes mellitus, Ramadan, fasting, education and risk factors. In addition, we also entered the keywords in the google scholar search engine and after getting any related article, we re-entered the title of that article in the ISI-Web of Science and PubMed. The title and abstract of the studies were evaluated to determine eligibility for the documents. All studies in which diabetes mellitus and Ramadan, fasting was discussed were considered eligible for inclusion. No limitations on publication status, study design or language of publication were obligatory. We reviewed 37 papers, finally we included 19 studies and remaining 18 studies were excluded from the study.

### **Ethics Statement**

In this study we reviewed the data base literature on diabetes mellitus and Ramadan fasting, hence, we did not require the ethical approval.

### **Data Analysis**

The extracted findings for diabetes mellitus and Ramadan fasting were entered into the computer program, SPSS Version 20 (SPSS Inc., Chicago, IL, USA), and findings were analyzed descriptively.

## **Results**

Table I shows the major complications of diabetic patients who fast during Ramadan. In

these patients there are multiple risk factors including age, type and duration of diabetes, levels of HBA1C, micro and macro-vascular complications. In addition, poverty, poor healthcare, lack of Ramadan focused diabetes education are major risk factors causing serious complications during fasting in the month of Ramadan.

## **Discussion**

The emerging diabetes hotspots in Muslim majority countries are the Middle East, Western Pacific, Sub-Saharan Africa and South-East Asia. Worldwide majority of diabetic patients fast during Ramadan irrespective of medical advice. The major complications of diabetic patients who fast during Ramadan are hypoglycemia, hyperglycemia, dehydration, diabetes ketoacidosis and cerebral venous sinus thrombosis<sup>11</sup>. There are multiple risk factors resulting in these complications including age, type of and duration of diabetes, uncontrolled level of HbA1c, micro and macro-vascular complications. In addition, poverty, poor healthcare, lack of Ramadan focused diabetes education are major factors causing serious complications during fasting in the month of Ramadan.

For all Muslim adults, fasting during Ramadan is one of the five pillars of Islamic practices. The holy book of Muslims (Holy Quran) specifically exempts the sick from the mandatory fasting during the month of Ramadan. Patients with diabetes fall under this category because their chronic metabolic disorder may place them at high risk for various complications.

Ramadan is a lunar-based month and its duration varies between 29 and 30 days and the fast-

**Table I.** Major Complications in diabetic patients during Ramadan Fasting.

<p><b>Hypoglycemia:</b> Change in eating patterns during Ramadan can increase risk of severe hypoglycaemia among both type 1 diabetes and type 2 diabetes<sup>7,9</sup></p> <p><b>Hyperglycemia:</b> Altered eating pattern during Ramadan may increase the incidence of severe hyperglycemia with or without ketoacidosis<sup>7</sup></p> <p><b>Diabetic ketoacidosis:</b> Diabetic patients especially type 1 diabetes are at increased risk for diabetic ketoacidosis particularly if patients are grossly hyperglycemic before Ramadan<sup>7,9</sup></p> <p><b>Dehydration:</b> The time period of fasting in Ramadan is variable from 12-20 hours, limitation of fluid intake during the fast can cause dehydration that may become worse in hot and humid climates and among individuals who perform hard physical labor</p> <p><b>Thrombosis:</b> Dehydration may contribute to hypercoagulable state in a patient with diabetes already known to have high levels of clotting factors, decreased endogenous anticoagulants and impaired fibrinolysis<sup>10</sup>. Increased blood viscosity secondary to dehydration may also enhance the risk of cerebral venous sinus thrombosis<sup>11</sup>, stroke and retinal vein occlusion<sup>12</sup></p> <p><b>Miscellaneous:</b> Headache, low blood pressure, weight loss, lack of concentration etc.</p>
---

ing month is brought forward by about 10 days each year, which means that over time the season in which Ramadan falls continue to change. This type of fasting is defined as periodic food and water deprivation during daylight hours with free access during the night for the duration of one lunar month. Depending on the geographical location and season, the duration of the daily fast may range from 12-20 h. The main effects of Ramadan are on diet, daily activity and medications.

During Ramadan the number of meals reduce to two, one large meal at sunset and one before dawn i.e. *Fatour* and *Sahour* respectively. Along with changes in number, timing and calorie content of the meals the composition of the meal is disturbed as well. During Ramadan, there is more consumption of fried foods and carbohydrates in the form of dates, juices and especially sweet foods. Moreover, the daily activities generally reduces during the daytime because of fasting and increased during the night.

Among otherwise healthy non diabetic people during the fast, circulating glucose levels tend to fall, leading to decreased secretion of insulin. Simultaneously, the levels of glucagon and catecholamines rise, stimulating glycogenolysis and gluconeogenesis. However, in patients with diabetes, this mechanism is disturbed due the underlying pathophysiology and the effects of pharmacological agents. Serious risks of fasting include hypoglycaemia, hyperglycaemia, and dehydration. Prolonged fast in the absence of adequate insulin can lead to excessive glycogenolysis, gluconeogenesis and ketogenesis, leading to hyperglycemia and ketoacidosis.

The EPIDIAR study<sup>7</sup> found that the change in eating patterns during Ramadan is associated with 4.7-fold increased risk of severe hypoglycaemia among type 1 diabetes and 7.5-fold in type 2 diabetes. Severe hypoglycemia was more frequent in patients in whom the dosage of oral hypoglycemic agents or insulin were changed and with a significant change in the lifestyle<sup>7</sup>.

In another study, the occurrence of hypoglycemia has been reported up to 20% in sulfonylurea-treated patients who were fasting in the month of Ramadan<sup>13,14</sup>, but other studies failed to report a significant increase in the frequency of hypoglycemia during Ramadan among patients treated with oral hypoglycaemic medications or insulin<sup>14,15</sup>.

EPIDIAR study<sup>7</sup> also showed a fivefold increase in the appearance of severe hyper-

glycemia during Ramadan in patients with type 2 diabetes and an approximately threefold increase in the occurrence of severe hyperglycemia with or without ketoacidosis in patients with type 1 diabetes<sup>7</sup>. Patients with diabetes, especially with type 1 diabetes, are at increased risk for development of diabetic ketoacidosis, particularly if they are grossly hyperglycemic before Ramadan<sup>7</sup>.

In addition to these complications, limitation of fluid intake during the fast, especially if prolonged, can cause dehydration that may become worse in hot and humid climates and among individuals who perform hard physical labor<sup>16</sup>. Furthermore, contraction of the intravascular space may also contribute to hypercoagulable state in a patient with diabetes already known to have high levels of clotting factors, decreased endogenous anticoagulants and impaired fibrinolysis<sup>10</sup>. Increased blood viscosity secondary to dehydration may also enhance the risk of cerebral venous sinus thrombosis<sup>11</sup>, stroke and retinal vein occlusion<sup>12</sup>.

Expert opinion recommends that if a patient has made it clear that they wish to fast the first step is to conduct a risk stratification<sup>17</sup>. Diabetes focused education is widely referred to as the cornerstone of care; and diabetes self-management education has proven effective in lowering complications<sup>18</sup>. But access to appropriate diabetes education is severely limited in many low and middle-income Muslim countries, and is non-existent in rural areas of the developing world<sup>11</sup>.

Patients who fasted during Ramadan without attending a structured educational session had an increase in hypoglycaemic events, whereas those who attended an educational program focusing on Ramadan had a significant decrease in hypoglycaemic events<sup>19</sup>.

## Conclusions

Still there are big gaps in the management of diabetic patients during Ramadan and the care of patients is fragmented; it is felt that diabetes during Ramadan is underestimated, under-investigated and needs more attention. It is vital to empower the healthcare workers and the patients in the frontlines with the appropriate information about Ramadan fasting in diabetic patients. In the short term to mitigate and preempt the problems faced by the patients, available resources should be mobilized to reach out

these patients efficiently and effectively. To bring about uniformity and avoid any misinformation simple, relevant and consistent patient education should be disseminated and translated into the major regional languages i.e. Arabic, Persian, Urdu, Turkish, Bengali, Hindi, Malay, English and French. Not only is it important what information to provide but how; in underprivileged communities, public places (schools, colleges, universities, mosques, public gatherings and charities) can be used for education and the role of media will be very useful. In order to assess the actual burden to improve the precision of the estimates and contribute to an evidence base that is fundamental for future strategy, the need for high-quality clinical trials and studies in this field, cannot be overemphasized. As a long term strategy more robust guidelines and recommendations should be formulated. Such an apparently huge challenge of fasting in Ramadan should be part of universal plan which then transcends into regional, national, provincial and local strategies so that it eventually reaches the patients.

The future development agenda needs to respond to a new epidemiological, demographic and political reality, and a paradigm shift is needed if progress is to be made. Fact remains that a significant majority of Muslims live in societies with primitive or poorly structured health care facilities and limited access and resources. Diabetic patients who fast during Ramadan should be adequately investigated and engaged in a structured Ramadan-focused diabetes education, thus empowering the patients to change their lifestyle during Ramadan to undertake the fast safely.

### Acknowledgements

The authors are thankful to the Deanship of Scientific Research, King Saud University, Riyadh, Saudi Arabia for supporting the work through Research Group Project (RGP-VPP 181).

### Conflict of Interest

The Authors declare that there are no conflicts of interest.

### References

- 1) WORLD MUSLIM POPULATION. Available at: <http://www.muslimpopulation.com/World/> Cited date August 22, 2014.
- 2) BUTLER D. Islam and Science: the data gap. *Nature* 2006; 444: 26-27.
- 3) WORLD BANK. World Bank Data, WHO parameters, 1999-2000. World Bank, 2000.
- 4) DIABETES RESEARCH AND CLINICAL PRACTICE AND ON THE IDF DIABETES ATLAS WEBSITE: Available at: [www.idf.org/diabetesatlas](http://www.idf.org/diabetesatlas), cited date August 28, 2014.
- 5) GUARIGUATA L, WHITING DR, HAMBLETON I, BEAGLEY J, LINNENKAMP U, SHAW JE. Global estimates of diabetes prevalence for 2013 and projections for 2035. *Diabetes Res Clin Pract* 2013; 103: 137-149.
- 6) RAMACHANDRAN A, SNEHALATHA C, YAMUNA A, MARY S, PING Z. Cost-effectiveness of the interventions in the primary prevention of diabetes among Asian Indians: within-trial results of the Indian Diabetes Prevention Programme (IDPP). *Diabetes Care* 2007; 30: 2548-2552.
- 7) SALT I, BÉNARD E, DETOURNAY B, BIANCHI-BISCAY M, LE BRIGAND C, VOINET C, JABBAR A; EPIDIAR STUDY GROUP. 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: 2306-2311.
- 8) SHEIKH A, GATRAD AR. *Caring for Muslim Patients*. Oxford, UK: Radcliffe Medical Press, 2000.
- 9) ZANTAR A, AZZOUQ S, BELHIMER F, CHENTLI F. Diabetes and Ramadan. *Presse Med* 2012; 41: 1084-1088.
- 10) BECKMAN JA, CREAGER MA, LIBBY P. Diabetes and atherosclerosis: epidemiology, pathophysiology and management. *JAMA* 2002; 287: 2570-2581.
- 11) SAADATNIA M, ZARE M, FATEHI F, AHMADI A. The effect of fasting on cerebral venous and dural sinus thrombosis. *Neurol Res* 2009; 31: 794-798.
- 12) ALGHADYAN AA. Retinal vein occlusion in Saudi Arabia: possible role of dehydration. *Ann Ophthalmol* 1993; 25: 394-398.
- 13) HAJEK P, MYERS K, DHANJI AR, WEST O, MCROBBIE H. Weight change during and after Ramadan fasting. *J Public Health (Oxf)* 2012; 34: 377-381.
- 14) BAKINER O, ERTORER ME, BOZKIRLI E, TUTUNCU NB, DEMIRAG NG. Repaglinide plus single-dose insulin glargine: a safe regimen for low-risk type 2 diabetic patients who insist on fasting in Ramadan. *Acta Diabetologica* 2009; 46: 63-65.
- 15) CESUR M, CORAPCIOGLU D, GURSOY A, GONEN S, OZDUMAN M, EMRAL R, UYSAL AR, TONYUKUK V, YILMAZ AE, BAYRAM F, KAMEL N. A comparison of glycemic effects of glimepiride, repaglinide, and insulin glargine in type 2 diabetes mellitus during Ramadan fasting. *Diabetes Res Clin Pract* 2007; 75: 141-147.
- 16) AHMAD J, PATHAN MF, JALEEL MA, FATHIMA FN, RAZA SA, KHAN AK, ISHTIAQ O, SHEIKH A. Diabetic emergencies including hypoglycemia during Ramadan. *Indian J Endocrinol Metab* 2012; 16: 512-515.
- 17) AL-AROUJ M, BOUGUERRA R, BUSE J, HAFEZ S, HASANEIN M, IBRAHIM MA, ISMAIL-BEIGI F, EL-KEBBI I, KHATIB O, KISHAWI S, AL-MADANI A, MISHAL AA, AL-

MASKARI M, NAKHI AB, AL-RUBEAN K. American Diabetes Association recommendations for management of diabetes during Ramadan. *Diabetes Care* 2005; 28: 2305-2311.

- 18) AL-AROUJ M1, ASSAAD-KHALIL S, BUSE J, FAHDIL I, FAHMY M, HAFEZ S, HASSANEIN M, IBRAHIM MA, KENDALL D, KISHAWI S, AL-MADANI A, NAKHI AB, TAYEB K, THOMAS A. Recommendations for management of diabetes during Ramadan, update 2010. *Diabetes Care* 2010; 33: 1895-1902.
- 19) HASSAN A, MEO SA, USMANI AM, SHAIKH TJ. Diabetes during Ramadan--PRE-approach model: presentation, risk stratification, education. *Eur Rev Med Pharmacol Sci* 2014; 18: 1798-1805.