Using Artificial Intelligence to Guide Physicians in Making Fasting Decisions for Diabetics During Ramadan

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Abstract

This manuscript explores the potential of artificial intelligence (AI) to assist physicians in making informed fasting decisions for diabetic patients during Ramadan, a period that poses significant health challenges due to extended fasting hours. It focuses on two main concerns: the increased risk of hypoglycemia, particularly in those with type 1 diabetes or type 2 diabetes who are on insulin therapy or insulin secretagogues, and potential adverse drug interactions due to the complexity of managing diabetes and other comorbid conditions during fasting. Emphasizing the utility of AI for optimizing medication schedules, the manuscript highlights the significance of continuous glucose monitoring systems (CGMs) and references the PROFAST study to underline AI's capability in assessing hypoglycemia risks. By showcasing AI's role in enhancing diabetic care through risk prediction and decision-making support, the manuscript calls for expanded research and the ethical integration of AI technologies in healthcare, underscoring its capacity to provide personalized support and improve health outcomes during Ramadan.

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Abbreviations

- CGMs: Continuous Glucose Monitoring
- AI: Artificial Intelligence
- IDF: International Diabetes Federation
- DAR: Diabetes and Ramadan

Millions of Muslims with diabetes navigate the holy month of Ramadan with unique challenges. Fasting and iftar times differ around the world; the pre-sunrise to sunset fast lasts anywhere from 12 to 18 hours depending on the location. While some choose to fast, others opt out due to health concerns [1].

537 million adults (20-79 years) are living with diabetes. This number is predicted to rise to 643 million by 2030 and 783 million by 2045 [2].

There are two challenges at Ramadan to decide to fast: a doctor shares the patient the decision. First, hypoglycemia is the biggest concern and challenge in diabetes management during Ramadan for those who decide to fast, especially in type 1 diabetes and type 2 diabetes with insulin therapy or insulin secretagogues [3].

The second challenge is drug interactions between anti-diabetic medications and other medications for other health problems, as many patients take many medications for diabetes and also for other co-morbidities, so drug interactions are suspected, like drug interactions between anti-hypertensive and antidiabetics. So, increased risk of hypoglycemia may

happen from drug interactions, especially if there are missed meals of Suhor or at elderly patients. Thus, there are guidelines like IDF-DAR Practical Guidelines 2021 that discuss the risks of fasting during Ramadan for those suffering from cardiovascular, cerebrovascular, and renal complications through risk stratification of patients with type 2 diabetes mellitus (T2DM) and risk-categorization for fasting and intention to fast [4].

During Ramadan, due to the short non-fasting hours, the patient focuses on taking his medications during this duration from iftar to Fajr, along with his three meals. Therefore, the patient needs to arrange his medications. If the patient has many medications for other comorbidities, such as heart problems, hypertension, thyroid diseases, or any other chronic diseases, it is challenging to avoid drug interactions and the risk of hypoglycemia during the daytime fasting hours. Thus, we need AI algorithms to help physicians arrange the medications during the non-fasting hours to avoid these interactions. Recent technological tools like CGMs help to provide continuous monitoring of glucose, but in developing countries, it is a challenge as there is still limited use of CGMs for the control of diabetes due to the high cost of these devices. It is useful to avoid hypoglycemia, especially in type 1 diabetes. Therefore, the use of artificial intelligence to assist physicians in making the right decision for patients, even before Ramadan, is a preventive step to complete Ramadan fasting without the complication of hypoglycemia. The use of artificial intelligence before starting Ramadan to choose the right medications for patients with diabetes mellitus with a low risk of hypoglycemia is crucial [5].

In a previous study, PROFAST used artificial intelligence to assess the incidence of hypoglycemia in people with type-2 diabetes mellitus (T2DM) who intake three or more anti-diabetic medications during Ramadan, but it did not help physicians decide whether to fast or not before the start of Ramadan [6]. Therefore, our novel perspective is to encourage researchers who are experts in machine and deep learning to develop AI algorithms for future use to help diabetic patients and healthcare providers, especially in developing countries with a lack of glucometers or CGMs due to poverty.

In recent years, the use of AI tools in medical devices has seen a significant rise. Approximately 700 FDA-approved devices based on AI have been authorized for use in the medical field. Given the scarcity of healthcare professionals and the prevalence of poverty in developing countries and remote areas with limited access to health services, there is a growing need for AI to assist physicians and patients remotely [7].

The US Food and Drug Administration has previously approved several AI- and ML-based medical devices related to diabetes, including those for automated retinal screening, clinical diagnosis support, risk stratification, and patient self-management tools. The term “medical devices using AI” has recently been specified more clearly as “AI-/ML-based medical devices.”

There is a growth in anti-diabetic medications, either oral, insulin, or non-injectable, and now there is a rise of many groups of medications developed like GLP-1 RA agonists and SGLT2 inhibitors.

There are new regulatory challenges with AI and ML. These technologies, in contrast to conventional medical equipment, can change and learn over time. This implies that their real-world performance may differ from their pre-market testing results. Better patient outcomes may result from this, but there may also be new hazards that must be controlled, which is difficult given that the algorithm is always evolving [8].

The value of AI-powered tools in the upcoming generation of healthcare technology is becoming increasingly apparent to the healthcare ecosystem. AI is thought to be able to enhance every step of the operation and delivery of healthcare. For example, one major factor driving the adoption of AI applications is the potential cost savings that AI may provide for the healthcare system. By 2026, AI applications are predicted to save the US healthcare system $150 billion annually. The shift in the healthcare model from a reactive to a proactive one, emphasizing health management over illness treatment, is largely responsible for these cost savings. It is anticipated that this will lead to a decrease in hospital stays, physician visits, and treatments. AI-based technology will play a significant part in maintaining people's health [9].

According to the FDA, the most devices enabled with AI are in radiology. Until the end of July 2023, the following categories will account for 79% of devices authorized in 2023: Radiology (85%), Cardiovascular (10%), Neurology (5%), Gastroenterology/Urology (4%), Anesthesiology (2%), and Ophthalmic (1%). Radiology has experienced the steadiest increase of AI/ML-enabled device submissions of any specialty. The FDA updates the list of AI/ML-Enabled Medical Devices periodically as there is growth in medical AI-based devices [10].

Artificial intelligence (AI) has revolutionized the healthcare industry by changing how we identify, treat, and monitor patients. With the capability to offer more personalized therapies and more accurate diagnoses, this technology is significantly enhancing healthcare research and outcomes. The application of AI in healthcare enables medical personnel to swiftly uncover signs of illness and trends that might otherwise be missed by analyzing large volumes of clinical records. AI has a wide range of potential uses in the healthcare industry, from predicting outcomes from electronic health records to analyzing radiological images for early detection [11].

Fortunately, advancements in artificial intelligence (AI), such as deep learning and machine learning algorithms, are emerging as a potential source of support. Let's explore how AI can assist diabetic patients during Ramadan to decide whether to fast or not, easily sharing decisions with doctors.

Conclusion

AI possesses the potential to revolutionize diabetic care during Ramadan. By providing personalized support, predicting risks, and guiding patient decisions, whether to avoid hypoglycemia or avoid drug-drug interactions as the hours of non-fasting are short per day, deep learning or machine learning algorithms can help physicians make correct decisions regarding whether diabetic patients should fast or not. AI can empower patients to approach the holy month with greater confidence and improved health outcomes. However, ethical considerations and continued research are essential to ensure the equitable and responsible implementation of this technology.

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