



# The FreeStyle Libre flash glucose monitoring system and the fasting month of Ramadan

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**Abstract:** The fasting month of Ramadan is a lunar month and Muslims abstain from eating, drinking, or using oral medications during this period. The duration of the fast starts before the beginning of dawn, ends at dusk and ranges between 12–19 hours. Management of diabetes during the fasting month of Ramadan can be challenging due to the amount and type of food consumption, physical activity, medications, and the duration of fasting. The main concern with fasting is the increased risk of hypoglycemia and hyperglycemia; therefore, capillary glucose monitoring is vital during Ramadan. The FreeStyle Libre (FSL) system (Abbott Diabetes Care, Alameda, CA, USA) is a unique interstitial system for monitoring glucose as it does not require user calibration. A patch sensor is fixed on the back of the upper arm and a hand reader is used to scan the sensor in order to receive the glucose readings. Several studies have shown that FSL is able to provide accurate glucose measurements when compared with capillary glucose blood results. The FSL results were not influenced by factors such as body mass index, age, type of diabetes, insulin administration, or hemoglobin A1c (HbA1c). The potential benefits of FSL were not tested during the months of Ramadan. Based on the safety and accuracy of FSL, further research is needed to assess the following: (I) whether the fast will have an impact on the accuracy of FSL; (II) how FSL can enable individuals with diabetes to complete the fast without encountering serious risks of hypoglycemia and hyperglycemia.

**Keywords:** Diabetes; FreeStyle Libre (FSL)

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The new FreeStyle Libre (FSL) system (Abbott Diabetes Care, Alameda, CA, USA) is based on a sensor placed over the skin in the back of the upper arm [interstitial glucose monitoring system (GMS)]. A hand reader is used to scan the sensor in order to receive the glucose readings. Besides the fact that it does not require user calibration, it is unlike a capillary glucose monitoring where you need to puncture the fingers in order to obtain a few drops of blood. Furthermore, the hand reader provides round-the-clock readings with a 15-min frequency, presents trends and alerts of glucose levels, and predicts the expected hemoglobin A1c (HbA1c) levels (1).

The FSL system is widely used in different parts of the world (1). Several studies have shown that the FSL system

can provide accurate glucose measurement when compared with capillary glucose blood results. For instance, Bonora *et al.* compared the performance of FSL and the gold-standard continuous glucose monitoring (CGM) Dexcom G4 Platinum (DG4P) (1). FSL and DG4P were offered to eight outpatients with type 1 diabetes for 14 days. In the analysis, there was a good correlation between FSL and DG4P [ $r^2=0.76$ ; mean absolute relative difference (MARD) =  $18.1\% \pm 14.8\%$ ]. The mean MARD was significantly higher during the days 11–14 than in days 1–10, and during hypoglycemia (19%), than in normoglycemia (16%) or hyperglycemia (13%). Average glucose profiles and MARD versus self-monitoring of blood glucose (SMBG) were similar between the two sensors. Time spent in normo-,

hyper-, or hypoglycemia, and indexes of glucose variability was similarly estimated by the two sensors. The authors concluded that there was a good agreement between the FSL and DG4P in individuals with type 1 diabetes (1). Bailey *et al.* assessed the performance of FSL against capillary blood glucose (BG) results (2). Seventy-two study participants with type 1 or type 2 diabetes were enrolled and a sensor was inserted on the back of each upper arm for up to 14 days. The accuracy of the results was demonstrated against capillary BG reference values and this was around 86.7%. The overall MARD was 11.4%. The mean lag time of the sensor was  $4.5 \pm 4.8$  min. Sensor accuracy was not affected by factors such as body mass index, age, type of diabetes, clinical site, insulin administration, or HbA1c. The authors concluded that the FSL system was found to be accurate when compared with capillary BG reference values, with accuracy remaining stable for 14 days. Importantly, the FSL system was shown to measure a glucose value that was lower than the reference method in patients undergoing cardiac surgery (3). Until further research is conducted to assess the performance of FSL in medical emergencies and surgical operations, the use of FSL will remain a potentially good option for stable patients. FSL is also proven to show high accuracy and precision in diabetic dogs (4). One of the biggest challenges during the fasting month of Ramadan is monitoring the plasma glucose level. This is important as it was shown that 43% of patients with type 1 diabetes and 79% of patients with type 2 diabetes fast during Ramadan worldwide (5).

Another difficult issue with Ramadan fasting is that the duration of the fast can range between 12 to 19 hours during the day (5). This can make individuals with diabetes who fast more vulnerable to encounter metabolic complications like hypoglycemia, hyperglycemia, dehydration, and diabetic ketoacidosis. Therefore, most of the published recommendations and guidelines about diabetes and Ramadan recommend education and trials of fasting for 2–3 days before Ramadan (5). Education is recommended due to the variation in the amount and type of food consumption, physical activity, medications, and the duration of fasting. Several relatively new anti-diabetic medications are in use to manage diabetes during the month of Ramadan. It is worth mentioning that the most recent anti-diabetic medications (for e.g., SGL2 inhibitors and new long-acting insulins) are not tested during Ramadan (5). This is likely due to the absence of a user-friendly system in monitoring glucose during fasting.

Taking all these factors into consideration, the FSL system may provide potential benefits in monitoring diabetes

during Ramadan. To our knowledge, the potential benefits of FSL have not been tested during the month of Ramadan. Based on the safety and accuracy of FSL, further research is needed to assess the following: (I) whether the fasting will have an impact on the accuracy of FSL as fasting can be associated with hormonal and biochemical changes; (II) how FSL can enable individuals with diabetes to complete the fast without encountering serious risks of hypoglycemia and hyperglycemia. This is important as many individuals with diabetes who fast want to avoid repeated puncturing of their fingers as this may not be acceptable during Ramadan. In order to keep the individuals safe and help continue their fast, it is important to test BG levels regularly.

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### References

1. Bonora B, Maran A, Ciciliot S, et al. Head-to-head comparison between flash and continuous glucose monitoring

- systems in outpatients with type 1 diabetes. *J Endocrinol Invest* 2016;39:1391-9.
2. Bailey T, Bode BW, Christiansen MP, et al. The Performance and Usability of a Factory-Calibrated Flash Glucose Monitoring System. *Diabetes Technol Ther* 2015;17:787-94.
  3. Schierenbeck F, Franco-Cereceda A, Liska J. Accuracy of 2 Different Continuous Glucose Monitoring Systems in Patients Undergoing Cardiac Surgery. *J Diabetes Sci Technol* 2017;11:108-16.
  4. Corradini S, Pulosio B, Dondi F, et al. Accuracy of a Flash Glucose Monitoring System in Diabetic Dogs. *J Vet Intern Med* 2016;30:983-8.
  5. Ahmed MH, Abdu TA. Diabetes and Ramadan: an update on use of glycemic therapies during fasting. *Ann Saudi Med* 2011;31:402-6.

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