Does Technology helps adolescents with type 1 diabetes in fasting Ramadan ?

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Outlines

- Introduction
- Ramadan as a holy month
- Can patients with Diabetes Fast ?
- Results of the Epidemiology of Diabetes and Ramadan 1422/2001 (EPIDIAR) study
- Usage of diabetes technology as a good tool for those willing to fast Ramadan
  - Improve knowledge and understand “ safe fast” during Ramadan
  - Be able to empower patients to make the right decision to avoid risks associated with fasting during Ramadan
- Recent published research on FGMS & fasting Ramadan

يَا أَيُّهَا الَّذِينَ آمَنُوا كُتِبَ عَلَيْكُمُ الصِّيَامُ كَمَا كُتِبَ عَلَى الَّذِينَ مِن قَبْلِكُمْ لَعَلَّكُمْ تَتَّقُونَ (183)

“ O you who believe! Fasting has been prescribed to you as it was prescribed to those before you so that you attain Taqwa (self restraint , God Awareness)”

Ramadan

- Fasting during the month of Ramadan is the fourth of Islam's 5 pillars of faith
- It is the ninth month of the Hijri calendar
- Fasting is obligatory for all pubertal Muslims and consists of abstaining from eating and drinking from dawn to sunset
- Complete fasting what is during the daylight hours for one full Lunar month (29-30days) which last 14- 18 hours depending on the geographical location

شَهْرُ رَمَضَانَ

ٱلَّذِىٓ أُنزِلَ فِيهِ ٱلْقُرْءَانُ هُدًى لِّلنَّاسِ وَبَيِّنَٰتٍ مِّنَ ٱلْهُدَىٰ وَٱلْفُرْقَانِ ۚ

فَمَن شَهِدَ مِنكُمُ ٱلشَّهْرَ فَلْيَصُمْهُ ۖ

وَمَن كَانَ مَرِيضًا أَوْ عَلَىٰ سَفَرٍ فَعِدَّةٌ مِّنْ أَيَّامٍ أُخَرَ ۚ

Exception from fasting

- Illness – Chronic
  - ***Diabetes***
- Those who can not understand the purpose of fasting-mentally challenged
- Elderly
- Travelers
- Women during menstruation, pregnancy, lactation
- Pre-pubertal children


Diabetes management in Ramadan

Can patients with Diabetes Fast?

Results of the Epidemiology of Diabetes and Ramadan 1422/2001 (EPIDIAR) study

OBJECTIVE

- The aim of study was to assess the characteristics and care of patients with diabetes in countries with a sizable Muslim population and to study diabetes features during Ramadan and the effect of fasting

- A population-based, retrospective, transversal survey conducted in 13 islamic countries
- A total of 12,914 patients with diabetes were recruited using a stratified sampling method, and 12,243 were considered for the analysis
- Investigators recruited 1,070 (8.7%) patients with type 1 diabetes and 11,173 (91.3%) patients with type 2 diabetes

Risks associated with fasting in T1DM

- Hypoglycemia:
  - 2-4% of mortality in patients with T1DM
    - More with hypoglycemia unawareness,
    - poor glycemic control and recurrent hypoglycemia in the past needing hospitalization
  - EPIDIAR study:
    - 4.7- fold increase in severe hypoglycemia (needing hospitalization) in patients with T1DM
    - 3-14 events /100 people/month

Diabetes Care 2004; 27:2306

Risks associated with fasting in T1DM

- Hyperglycemia
  - 3 fold increase in severe hyperglycemia with or without ketoacidosis in patients with T1DM (from 5 to 17 events /100 people/month.
- Due to excessive reduction of insulin to prevent hypoglycemia, increase intake of food and sugar drinks.

Diabetes Care 2004; 27:2306

Risks associated with fasting in T1DM

- Diabetic Ketoacidosis:
  - More in patients with poorly controlled diabetes before Ramadan
  - The risk is increased because of decreased insulin dose (assuming that food intake is reduced(
  - Risk for dehydration
  - Dose reduction in response to acute infection
  - However, it remains non-conclusive
    - %1.8of T1DM patients developed DKA during Ramadan, same as non-fasting months

*Diabetes Care 2004; 27:2306
** Abusrewil et al 2003 Jamahiriya Med J; 2:99

Risks associated with fasting in T1DM

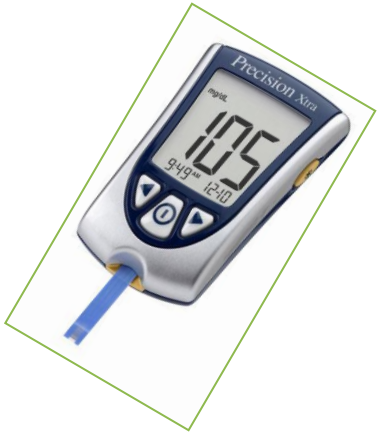
- **Dehydration and thrombosis:**
  - Increased incidence of retinal vein occlusion
  - However, coronary artery events or stoke were not increased in Ramadan
  - Limitation of fluid intake can lead to dehydration
  - Hot and humid climates → increase the risk
  - Also, hyperglycemia → osmotic diuresis → fluid and electrolyte imbalance

Diabetes Technology has A huge impact to help IDDM patients to normalize their life style !!

New technology in diabetes

Glucose Monitoring
Invasive Vs Non - Invasive

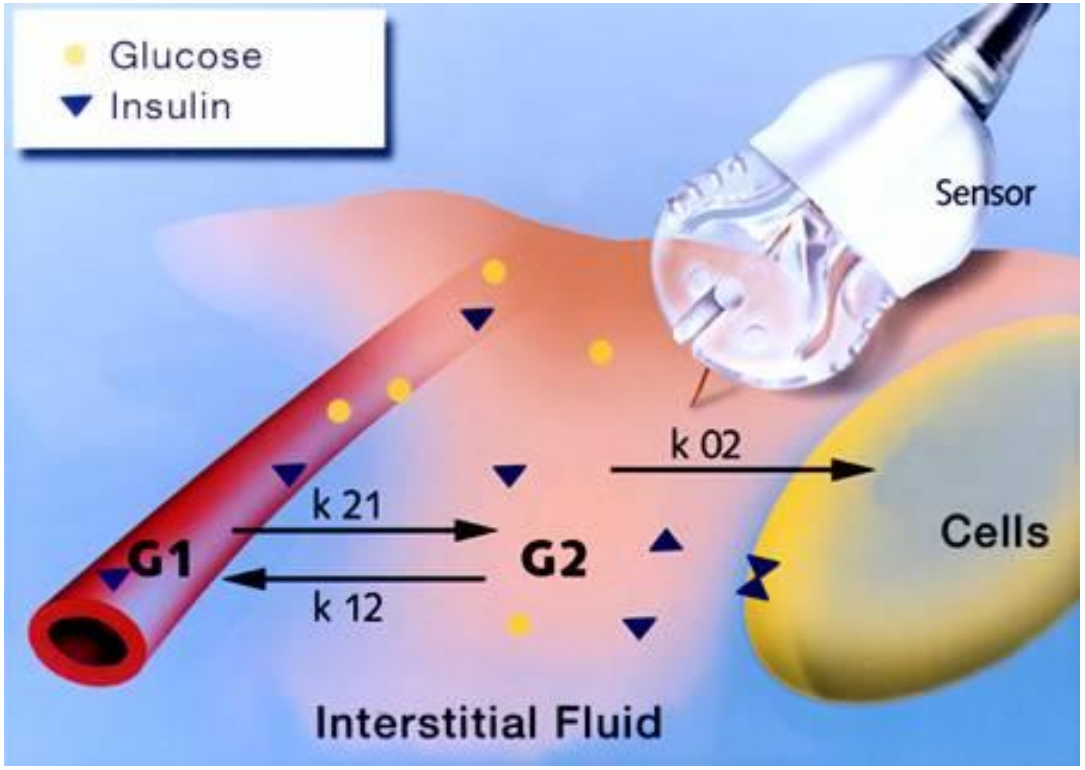
Current various glucometers



Non invasive Glucose Monitoring

- Non invasive sensors ,use a plastic needle containing a sensor inserted into the subcutaneous
- Enzymatic sensors using Glucose Oxidase are the currently used sensing systems
- Various types/ various companies
- They are replaced every 7 days and require calibration 2-3 times daily with SMBG
- FGMS (free style – Libre) by Abbott , not continuous but has advantages of 14 days sensor and no calibration, with cheapest price among all other non invasive sensors

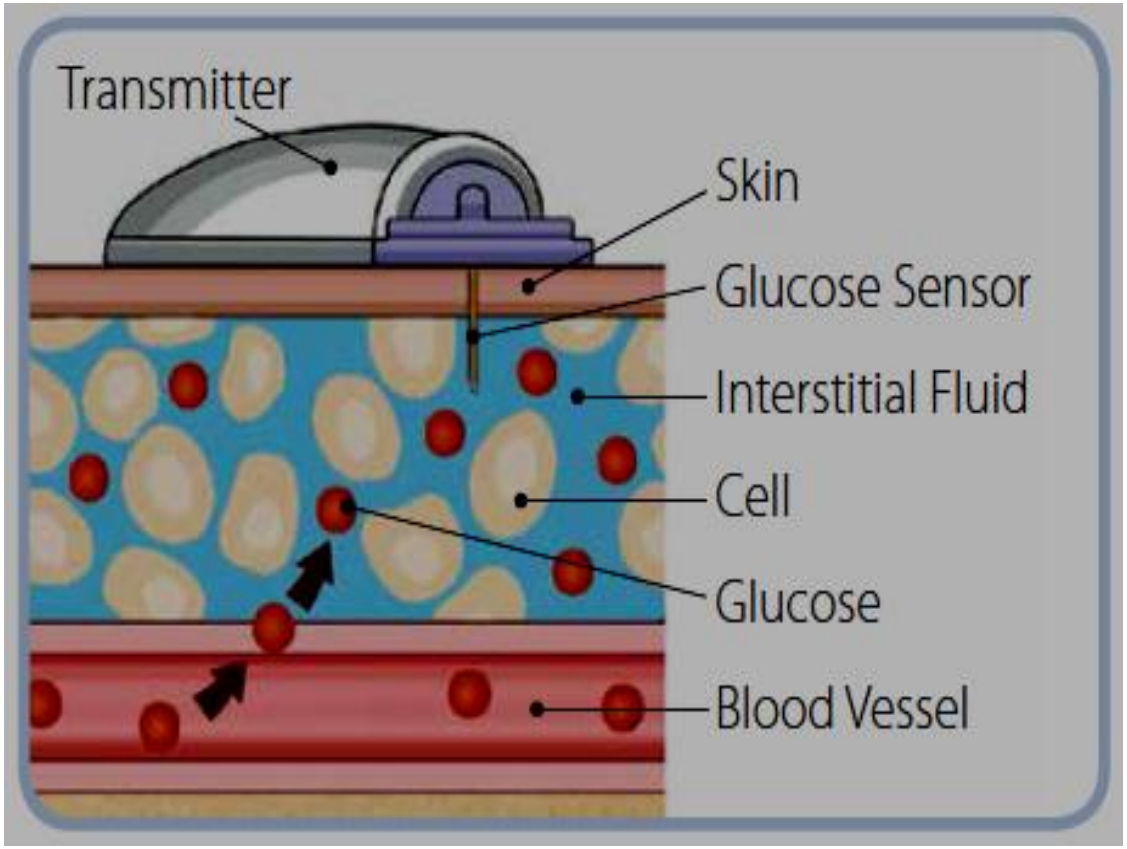
Interstitial Fluid Glucose Measurement



Interstitial fluid glucose (G2) is almost always comparable with blood glucose (G1)

How Does CGM Work?

- Glucose in the **interstitial fluid** hits the sensor causing an glucose-oxidation reaction to occur



Availability of various CGMS

Abbott Freestyle Navigator®

Limitations of CGMS

- Interference with glucose readings by sensor can occur with certain substances
  - i.e.gluthatione, ascorbic acid, uric acid, salicylates
- Lag-time for up to 15 minutes when glucose changes rapidly
- **(MARD = mean average reading deviations)**
  - Overall percentage of error – near 15%
  - Guardian REAL-Time – 17%
  - DexCom - 11-16%
  - Navigator 12-14%

* E. Cenzic, MD and William tamboriane, MD. *A Tale of Two Compartments: Interstitial Versus Blood Glucose Monitoring.* DIABETES TECHNOLOGY & THERAPEUTICS. Volume 11, September 2009.

How could non invasive technology be useful in fasting Ramadan ?

- Non invasive technology could provide consequence better glycemic control by continuous observation of glucose reading by participants and parents.

- Non invasive technology could help diabetic patients to fast in a safer manner, as it has the capability to show changes in glucose levels at any time throughout the day and night.

Insulin Pump Technology & Ramadan

Insulin Pump Therapy: Present

Sensor Augmented Pump

Trend Graphs
Shows the effect of diet, exercise, medication and lifestlye on glucose levels.

Alarms
Protect patients by warning of low and high glucose levels.

Continuous Readings
Help patients take action sooner
Up to 288 glucose readings per day, every 5 minutes, 24 hours a day

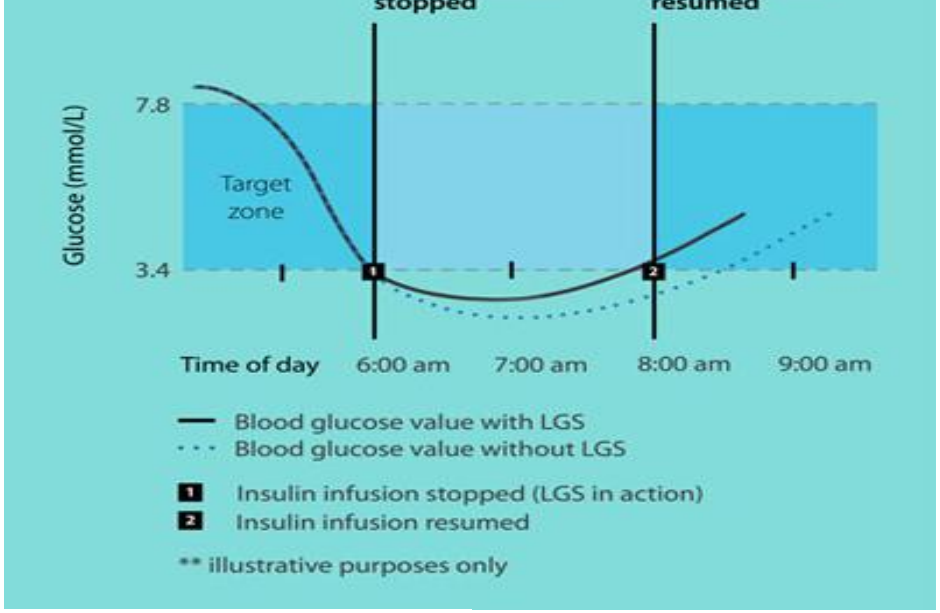
Glucose Sensor
Up to 3-day of continuous use.

Trend Arrows
Point up or down to show the direction and rate of change in glucose levels

Wireless Transmitter
Small, discreet and waterproof

Sensor Augmented Insulin Pumps (SAP)

Medtronic MiniMed 530G system



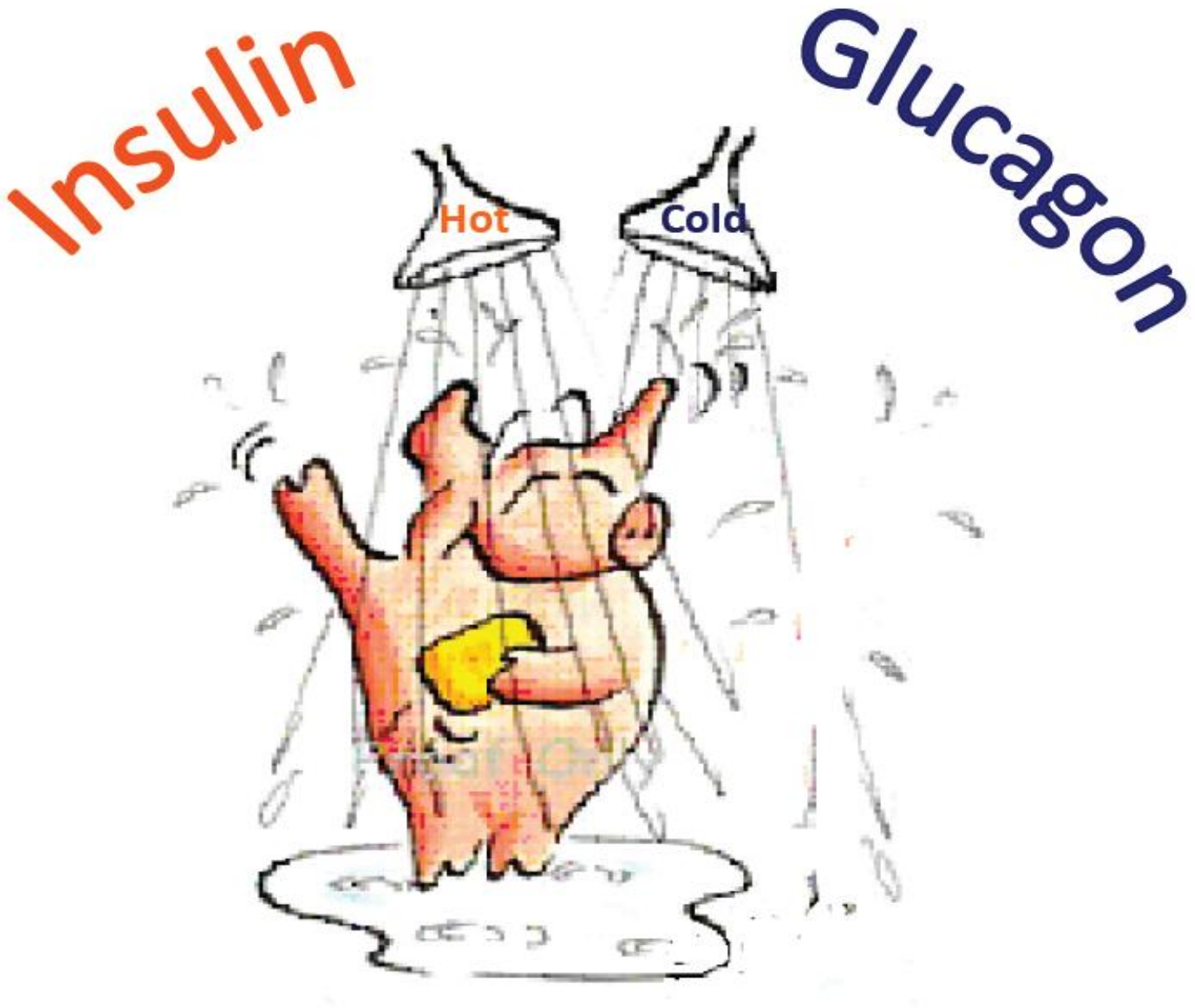
Animas Vibe system

‘SMARTGUARD™ TECHNOLOGY PROVIDES ADVANCED PROTECTION AGAINST HYPOGLYCEMIA (AUTO SUSPENSION & AUTO-RESUME OF INSULIN)

Bionic Pancreas – the iLet
Dual Chamber pump (Glucagon and Insulin Reservoir)

http://sites.bu.edu/bionicpancreas/about-us/the-bionic-pancreas-ilet/

Ilet -"Bionic Pancreas"


Insulin
Glucagon
Hot
Cold

Breaking News: FDA Approves the MiniMed 670G System, World's First Hybrid Closed Loop System

September 28, 2016

Medtronic's 670G

- "hybrid-closed loop" system with Enlite 3 CGM sensor
- Software automatically increases/decreases insulin delivery to target a blood glucose of 120 mg/dl
- Give bolus for meals
- Notify - exercise

Resently published research regarding FGMS

Flash glucose monitoring system may benefit children and adolescents with type 1 diabetes during fasting at Ramadan

Abdulmoein E. Al-Agha, FRCPCH, Shahd E. Kafi, MBBS, Abdullah M. Zain Aldeen, MBBS, Raghdah H. Khadwardi, MBBS.

ABSTRACT

الأهداف: ملاحظة وتقييم فوائد استخدام جهاز قياس السكر المنتظم فري ستايل لبري (FGMS) للاطفال واليافعين المصابين بالنوع الأول من مرض السكري أثناء صيام شهر رمضان المبارك.

الطريقة: هذه دراسة وصفية تشمل 51 مشارك يزورون عيادة السكري للاطفال في مستشفى جامعة الملك عبد العزيز بجدة، المملكة العربية السعودية في الفترة الممتده من 5 يونيو وحتى 6 يوليو 2016. تم تعريف نقص السكر في الدم كقيم الجلوكوز اقل من 70 ملغ / ديسيلتر، بينما ارتفاع السكر في الدم كقيم الجلوكوز أكثر من 150 ملغ/دل لجميع المشاركين على أساس بروتوكول معهدنا.

النتائج: تمكن المشاركون في البحث من صيام مايقارب 67.0% من المجموع الافتراضي لأيام الصيام المسجلة خلال هذه الدراسة مقابل مايقارب 33% من أيام الأفطار وكان ذلك إما بسبب انخفاض مستوى السكر (15.4%) أو اسباب اخرى لا علاقة لها بمرض السكري (17.6 %). لم تتواجد اي حالة خطيرة تصاحب شدة الانخفاض. متوسط حالات ارتفاع نسبة السكر (1.29) في أوقات الصيام يعتبر اكثر حدوثاً بالمقارنة مع متوسط الانخفاض أوقاته (0.7) كما لم يلاحظ وجود أي حالات لمرض الحماض السكري الكيتوني خلال فترة الدراسة. في الختام متوسط التحليل التراكمي للسكر قبيل حلول الشهر الكريم بالمقارنة مع متوسطه بعده 16% ± 1.64 إلى 8.2 % ± 1.63).

الخاتمة: ساعد استخدام جهاز قياس السكر المنتظم للاطفال واليافعين المصابين بالنوع الاول من السكري في تحقيق رغبتهم لصيام الشهر الفضيل دون حدوث أي مضاعفات قد تضر صحتهم اضافة إلى التعليم النوعي وتنظيم مستوى السكر قبيل رمضان إلى جهاز قياس السكر المنتظم يؤدي إلى نتائج افضل.

Objectives: To assess the benefit of using the flash glucose monitoring system (FGMS) in children and adolescents with type 1 diabetes mellitus (T1DM) during Ramadan fasting.

Methods: A prospective pilot study of 51 participants visited the pediatric diabetes clinic at King Abdulaziz University Hospital, Jeddah, Kingdom of Saudi Arabia from between June until and July 2016. The FreeStyle® Libre™ FGMS (Abbott Diabetes Care, Alameda, CA, USA) was used. Hypoglycemia was defined as glucose values of less than 70 mg/dL, while hyperglycemia as glucose values of more than 150 mg/dL for all participants based on our institute's protocol.

Results: Participants were able to fast for 67.0% of the total days eligible for fasting, whereas they did not fast on 33% of the days due to either hypoglycemia (15.4%) or non-diabetes-related reasons (17.6 %). None of the participants developed severe hypoglycemia. The mean number of hyperglycemic episodes during fasting hours was 1.29, per day, which was higher than that of hypoglycemic episodes (0.7). None of the participants developed diabetic ketoacidosis (DKA). Glycemic control with mean of estimated hemoglobin A1C reading during Ramadan (8.16 ± 1.64% [pre study]) to 8.2 ± 1.63% [post study] p=0.932.

Conclusions: Children and adolescents with T1DM who use the FGMS could fast without the risk of life-threatening episodes of severe hypoglycemia (namely seizure, coma), or DKA during Ramadan. Adequate education and good glycemic control prior to Ramadan are important strategies in combination with the use of an FGMS to achieve better outcome.

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Al-Agha AE, et al. Saudi Med J. 2017.

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Abstract

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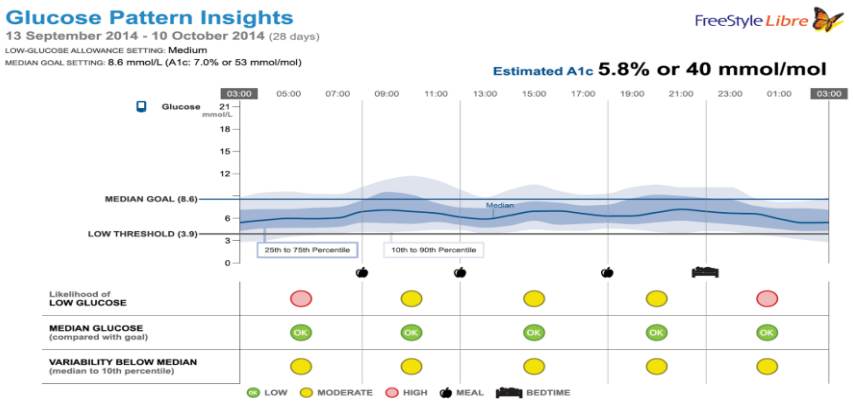

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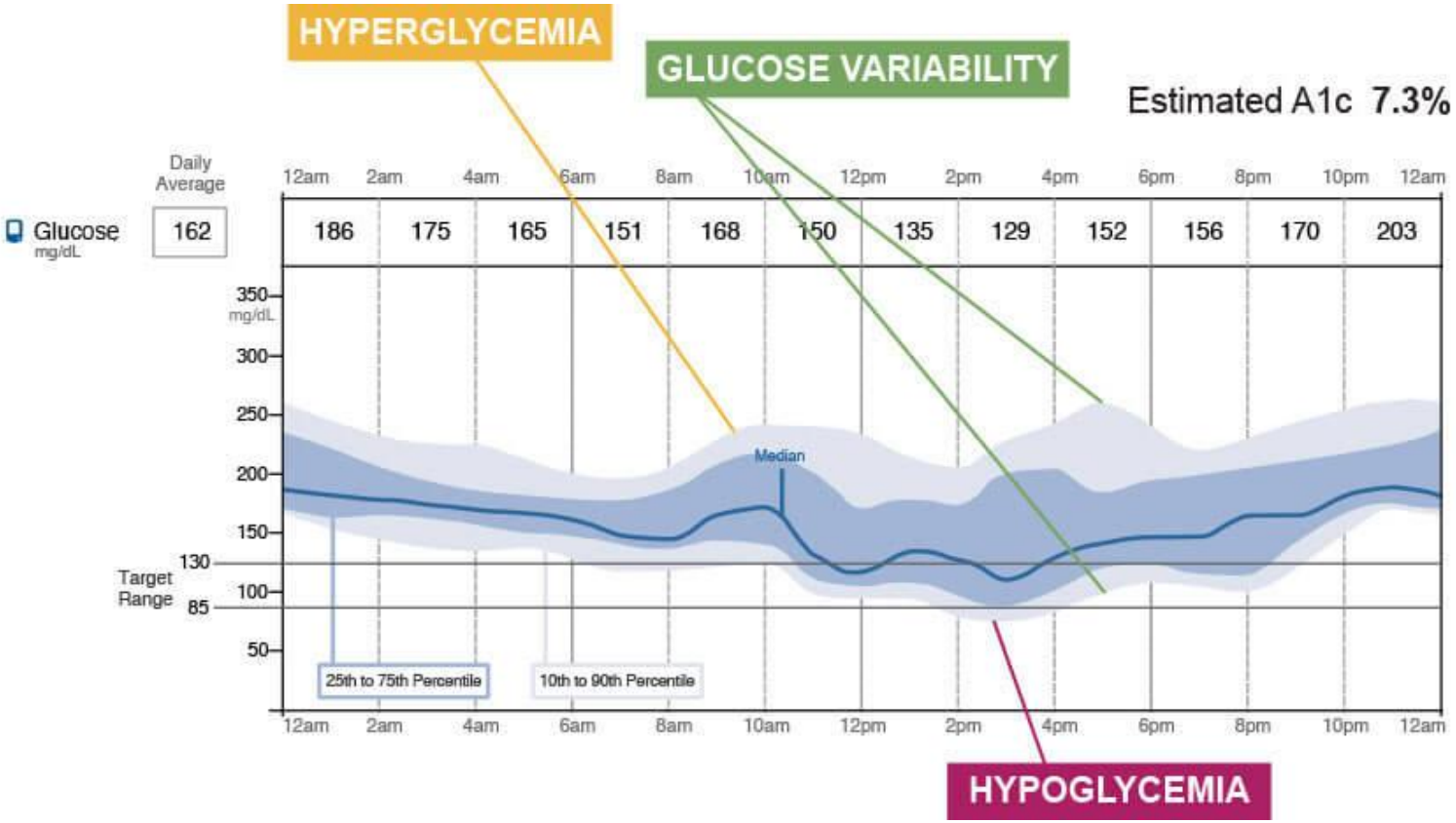
Glucose readings the day representing its variability among the accepted target range :



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Conclusions:

- Children and adolescents with T1DM who use the FGMS could fast without the risk of life-threatening episodes of

➢ severe hypoglycemia (namely seizure, coma), or

➢ DKA during Ramadan.

- Adequate education and good glycemic control prior to Ramadan are important strategies in combination with the use of an FGMS to achieve better outcome.

Conclusions

- Non – invasive glucose monitoring is helping all patients to monitor their glucose variability continuously and adjusting their insulin doses much better than SMBG
- SmartGuard™ Technology provides advanced protection against Hypoglycemia (Auto Suspension & auto-resume of insulin)
- FDA has Approved MiniMed 670G System, World's First Hybrid Closed Loop System in September 28, 2016 with strong hope that, further artificial pump technology will be advancing gradually to help all people with type 1 diabetes which definitely will help to fast Ramadan safely


ربي أدخل شهر رمضان علينا وأنت راضٍ عنا
واجعله شهراً تبدل فيه ذنوبنا إلى حسنات
وهمومنا إلى أفراح وأحلامنا إلى واقع

Thank you