



# EFFICACY AND SAFETY OF INSULIN DEGLUDEC AS A BASAL INSULIN IN ADOLESCENTS WITH TYPE 1 DIABETES DURING RAMADAN FASTING: A SINGLE CENTER OBSERVATIONAL STUDY WITH FREESTYLE LIBRE FLASH GLUCOSE MONITORING SYSTEM

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## INTRODUCTION

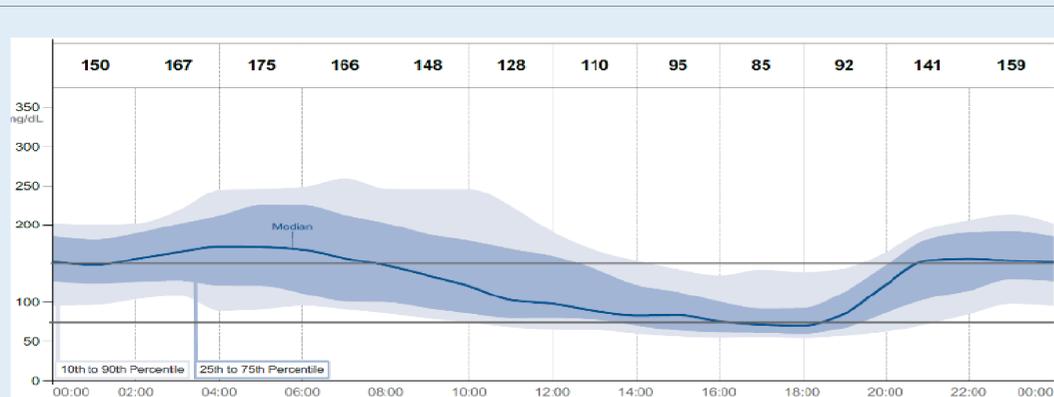
- Many Muslim adolescents and children insist on fasting during the holy month of Ramadan often for social and cultural belonging as well as religious sense of fulfillment. The various potential risks of fasting during Ramadan, including hyperglycemia, hypoglycemia, ketoacidosis, and dehydration. However, the risk of hypoglycemia during the daytime is by far the most disliked complications as its treatment entails the intake of carbohydrate with resulting premature breaking of the fast, which induces a sense of guilt and failure by the faithful patients.
- Insulin degludec (IDeg) as part of a basal-bolus regimen, is an ultra-long-acting insulin, with flat time-action profile, having a lower risk of hypoglycemia.

## AIM OF THE WORK

- The aim of this study is to assess the frequency, timing and severity of hypoglycemia of insulin IDeg as a basal insulin in T1DM adolescence who are willing to fast. Other outcomes included glycemic control, number of days needed to break fasting, and acute glycemic complications.

## SUBJECTS AND METHODS

- **Study design:** This cross-sectional study included children and adolescents with type 1 diabetes mellitus aged  $\leq 20$  years with no microvascular complication. Thirty eight patients (19 males) with T1DM (mean age  $15.8 \pm 3.4$  years) and duration of diabetes ( $5.2 \pm 1.7$  years). Only children and adolescents with type 1 diabetes who intended to fast during Ramadan were included.
- Three months before Ramadan, clinical and laboratory evaluations were undertaken along with the whole education sessions, committed to follow up the given instructions and were able and willing to perform the required reliable data collection for the study.
- The following groups of patients were excluded: patients with recent history of diabetic ketoacidosis (DKA), if they had more than one episode of severe hypoglycemia (resulting in coma or seizures or requiring medical assistance) in the previous 6 months; if they had been hospitalized or had visited the emergency room for symptoms related to uncontrolled diabetes in the previous 6 months. Also, patients were excluded if they had diabetic microvascular complications or macrovascular disease.
- In Egypt, fasting was approximately 16 hours during Ramadan, and was 29 days. Fasting hours started from around 03:00 am and ended around 07:00 pm.
- Patients had their IDeg doses titrated using pre-iftar (sunset-meal) and pre-Suhur (sunrise-meal) glucose values.
- Target glucose values were aimed to be a pre-Suhur value of 120 mg/dl, and pre-iftar value of 130-150 mg/dl. Participants were able to adjust their bolus doses according insulin to carbohydrates ratios for each meal.
- IDeg was reduced initially by 15% of pre-Ramadan dose and administered at time of iftar. Patients were monitored using the FreeStyle Libre® flash glucose monitoring (FGM) system.
- Hypoglycemia was analyzed as overall (severe or plasma glucose  $< 3.1$  mmol/L [ $56$  mg/dL]), nocturnal (00:01-05:59) or severe (requiring assistance of another person). The primary outcome was rates of hypoglycemia.
- Analysis of hypoglycemia were extracted from downloads and compared between different times according to eating pattern in Ramadan Figure[1].



Figure[1]:Download of blood glucose pattern during fasting in Ramadan

## RESULTS

- At the end of Ramadan, mean BG was  $176 \pm 49$  mg/dl and overall time spent in hypoglycemia was  $5.7\% \pm 3.0\%$  of total monitoring period.
- The rate of hypoglycemia according to time intervals was 0%, 3%, 8%, 15% and 64% in (19:00–24:00), (24:00–04:00), (04:00–10:00), (10:00–14:00) and (14:00–19:00) respectively Figure [2].
- Out of all hypoglycemic flashes for patients, 72% were between 60 and 69 mg/dl, 23% between 50 and 59 mg/dl, and 5% below 50mg/dl. The mean number of episodes of breaking fast was 3 (1-7) Figure[3].
- There was no significant change ( $p = 0.211$ ) in glycemic control measured by fructosamine level between pre-Ramadan ( $221.7 \pm 63.8$  mg/dL) and end-of-Ramadan ( $234.8 \pm 71.7$  mg/dL).
- Insulin bolus dose had increased by 15% of the starting dose ( $p = 0.03$ ) while basal insulin was reduced by  $35 \pm 18\%$ .
- No DKA or hospital admissions were reported.

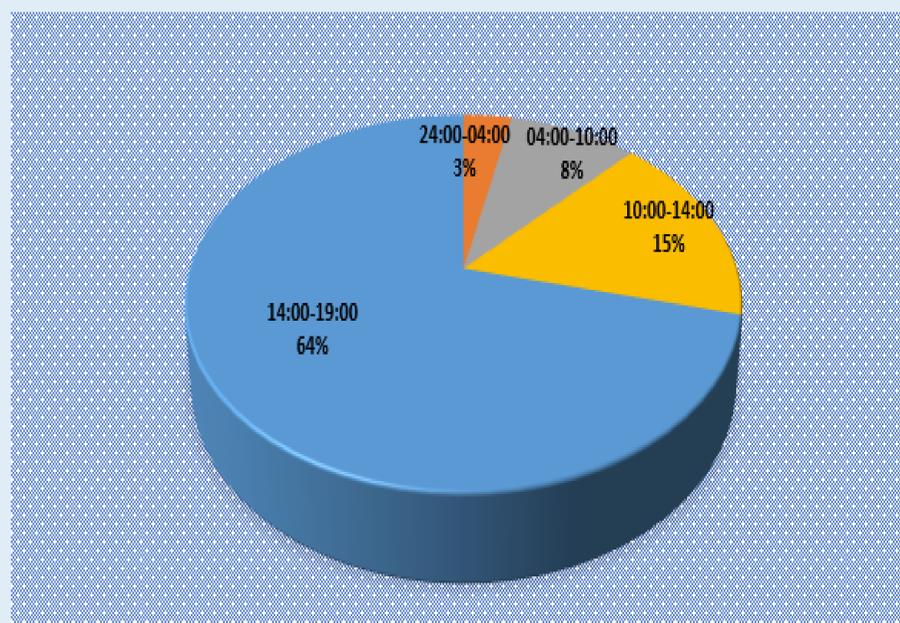


Figure [2]:Rate and timing of hypoglycemia in adolescents with T1DM during Ramadan fasting

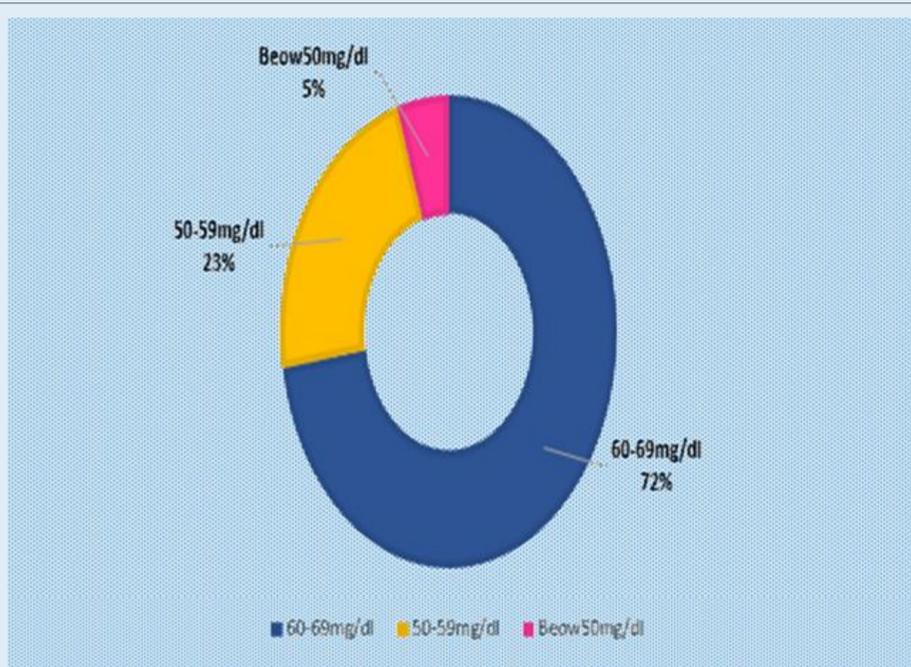


Figure [3]: The mean percentage of hypoglycemia levels during fasting

## CONCLUSION

- The present study concluded that once daily dosing of IDeg provides safe and effective alternative for glycemic control with a significant lower risk of hypoglycemia.
- Hypoglycemia was encountered in the last few hours of fasting preceding iftar time necessitating dose reduction to minimize the severity and duration of hypoglycemia. This helps adolescents with T1DM observe Ramadan in a healthy and fulfilling manner under close supervision.
- Using low-peak basal insulin and rapid-acting pre-meal insulin, under strict blood glucose- monitoring, close supervision and proper education, patient can fast Ramadan.