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Institut für Diabetes-Technologie

Forschungs- und Entwicklungsgesellschaft mbH an der Universität Ulm

Characteristics of nocturnal hypoglycaemic events and their impact on glycaemia

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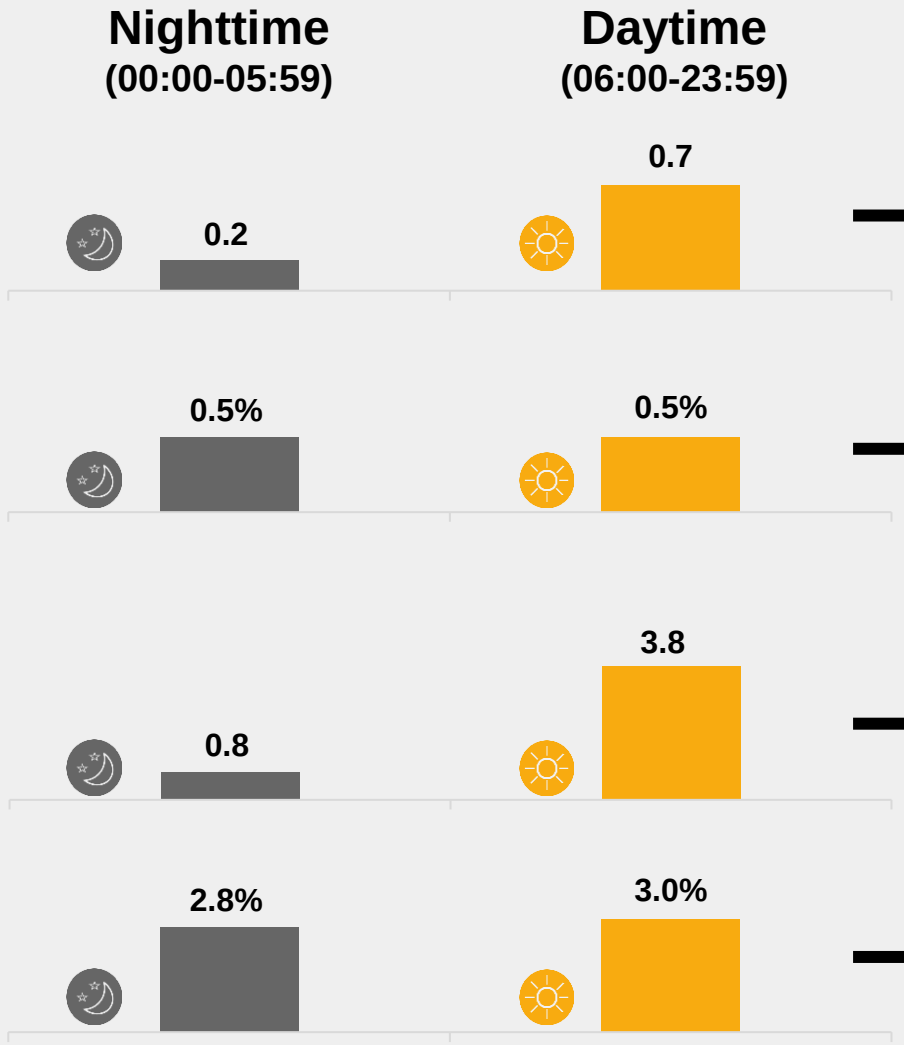
Background and Aims

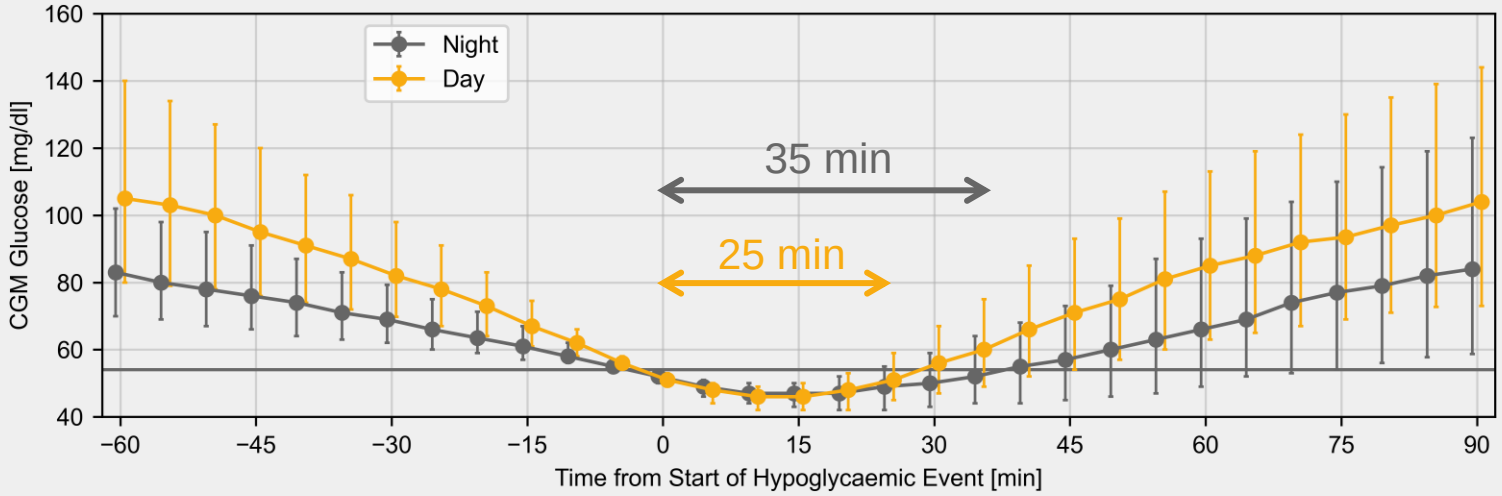
- Nocturnal hypoglycaemia is major burden for people with diabetes using insulin, in particular when using multiple daily injection (MDI) therapy
- Aim: Examine the extend of the problem in CGM data from 185 study participants with type 1 diabetes using MDI therapy (24.4 patient-years of data)
  - How frequent nocturnal hypoglycaemic events?
  - How are they different from hypoglycaemic events during the day?
  - What is their impact on glycemia the following day?

Results: Occurrence

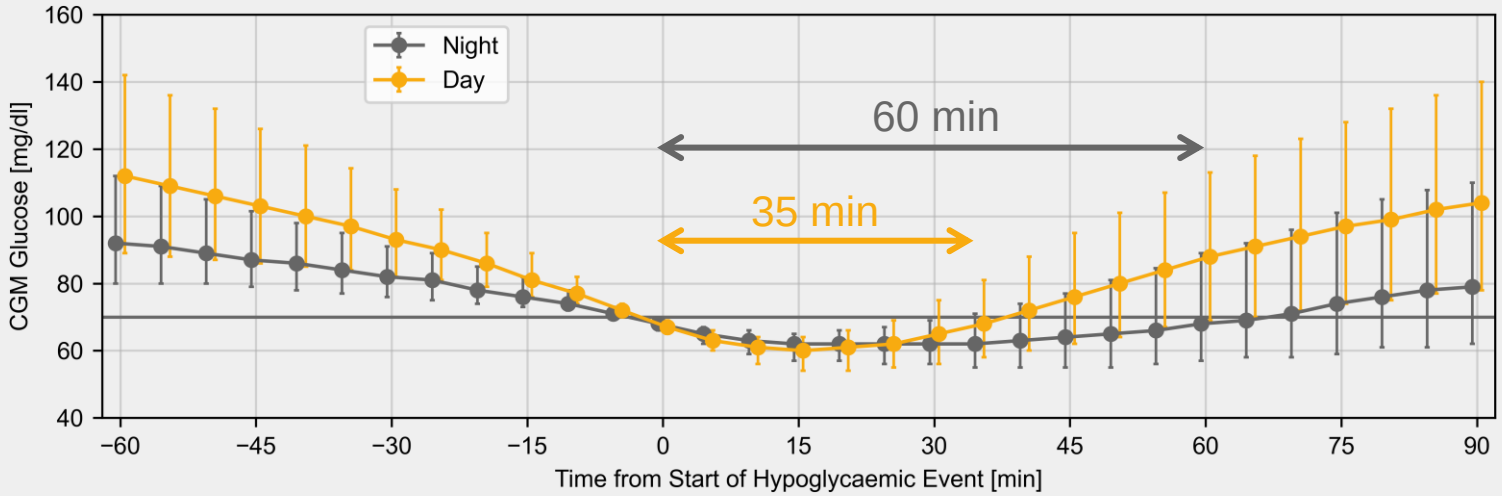


Results: Time Course

Hypoglycaemic events
below 54 mg/dl

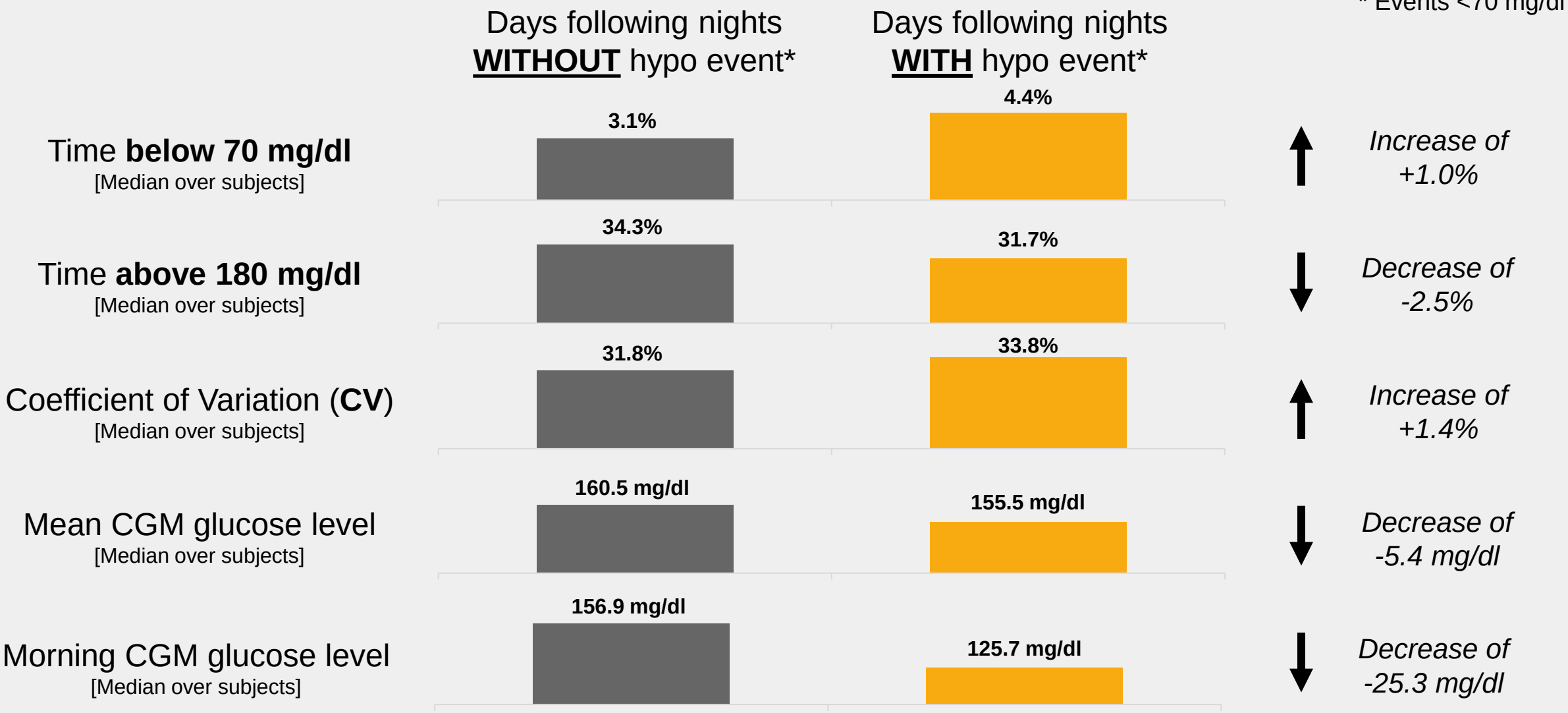


Hypoglycaemic events
below 70 mg/dl



Results: Impact on Glycaemia

* Events <70 mg/dl



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Background and Aims

Nocturnal hypoglycaemia is a burden for people with diabetes, particularly when treated with multiple daily insulin injections (MDI). However, the characteristics of nocturnal hypoglycaemic events in this cohort and their impact on glucose levels during the following day have not been examined comprehensively.

Characterisation of Nocturnal Hypoglycaemia

Hypoglycaemic events were identified from continuous glucose monitoring (CGM) data as episodes of consecutive CGM data <70 mg/dl or <54 mg/dl, respectively, for at least 15 minutes. Time below range (TBR), time in range (TIR), time above range (TAR) and coefficient of variation (CV) as well as the incidence of hypoglycaemic events per week were calculated for nocturnal (00:00-05:59) and diurnal (06:00-23:59) periods (Figure 1). Glucose traces preceding and following nocturnal and diurnal hypoglycaemic events were characterized (Figure 2).

Assessment of Impact on Glycaemia

The effect of nocturnal hypoglycaemic events on glucose levels during the following day was assessed by examining participant-level differences in diurnal TBR, TIR, TAR, CV, mean glucose and mean morning glucose levels (06:00-07:59) between days with and without at least one nocturnal hypoglycaemic event the previous night (Figure 3).

Participant and Data Characteristics

Study population: People with type 1 diabetes treated with MDI (n=185)

- Mean age 41.8 ± 12.3 years
- 112 (60.5%) male participants
- Mean HbA1c 7.6 ± 1.3 %
- Mean diabetes duration 15.5 ± 11.4 years
- 48.1 ± 13.8 days of CGM data per participant
- 8905 days (24.4 years) of CGM data

Results

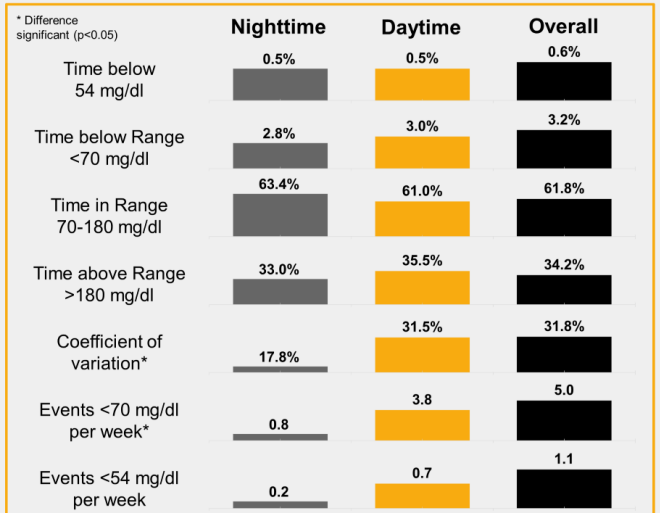

Figure 1: Glycaemic control metrics and incidence of hypoglycaemic events during the complete study (overall), and separated by night- and daytime. Results are given as median over the entire study population.

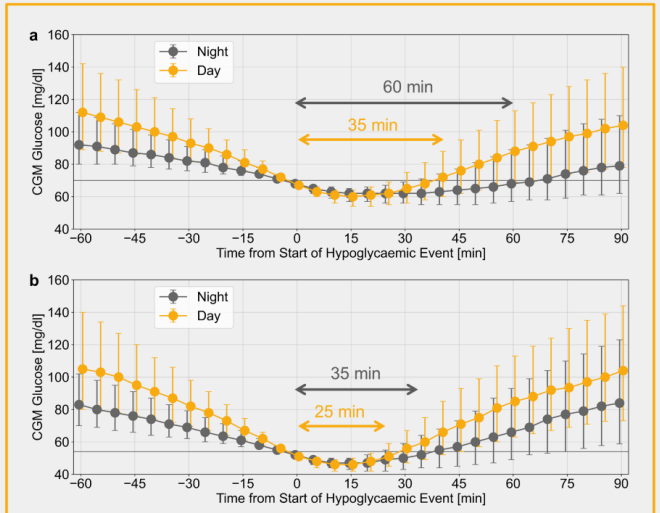

Figure 2: Median time profiles and interquartile range (error bars) of nocturnal and diurnal hypoglycaemic events normalized to the start of the events with CGM readings <70 mg/dl (panel a) and with CGM readings <54 mg/dl (panel b).

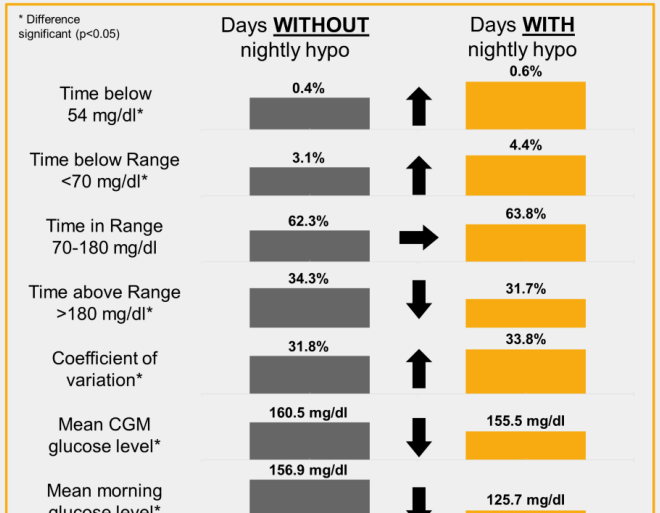

Figure 3: Diurnal (06:00-23:59) glycaemia metrics on days with and without Nocturnal Hypoglycaemic Events. Results are presented as median.

Conclusions

This analysis showed that nocturnal hypoglycaemic events are common in people with type 1 diabetes using MDI. Significant differences between the characteristics of nocturnal and diurnal hypoglycaemic events were observed. Additionally, it was found that nocturnal hypoglycaemic events have an impact on glycemia during the following day, albeit with a limited effect size. In particular, the opposite of the Somogyi effect, describing increased morning glucose levels after a night with hypoglycaemia, was observed.

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